Engineering Library MAY 11 1918 UNIV. OF MICH. LIBRARY

NOTICE TO READER.
When you finish reading this magazine place a 1-cent stamp on this notice, mail the magazine, and it will be placed in the hands of our soldiers or sailors destined to proceed over-seas.
NO WRAPPER—NO ADDRESS.
A. S. BURLESON,
Postmaster General.

TELEPHONE ENGINEER

Volume XIX *CHICAGO, MAY, 1918* *Number 5*

The AUTOMATIC SYSTEM Cuts Operating Labor Cost 60%

In October, 1916

It cost a certain company 61.3 cents per station for labor to operate and maintain its 1500-telephone manual plant.

In October, 1917

Ten months after cutting over to Automatic, this company operated its 3300-telephone system for 23.6 cents per station for labor.

A Reduction of 60 Per Cent

although the number of subscribers more than doubled and the average wage per employe went up 25 per cent.

The Maintenance and Labor Cost in this Exchange is only 96 cents per station per year

AUTOMATIC ELECTRIC COMPANY
CHICAGO

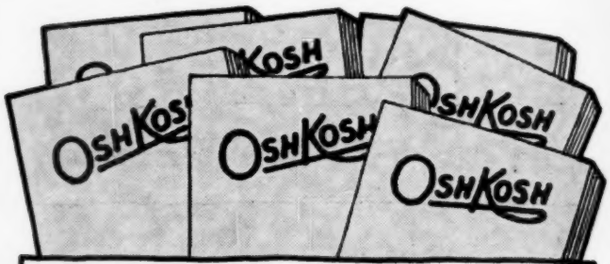
We are at the men's library

LISTEN

A removable shell operator's receiver.
Self contained in aluminum case.
It saves repair and express bills in case of breakage.
Broken shells easily replaced.

The best head-band receiver made.

THE HOLTZER-CABOT ELECTRIC CO.
6161-5 So. State St. CHICAGO, ILL.



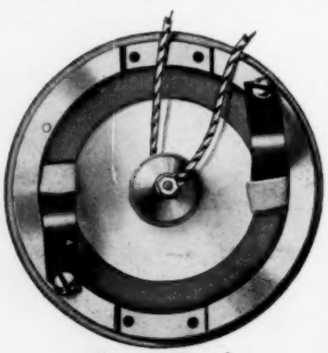
If you expect to buy construction tools this year you will want a copy of the **OSHKOSH** Cataloque

Oshkosh Mfg. Co.
OSHKOSH, WIS.

The Skinderviken Transmitter Button

Actual Size

ANYONE can install it immediately on any transmitter diaphragm.
TALKS in ANY position. Uses no bridge.
SAVES batteries.
Excludes side tones and makes voice more distinct.
Cuts down repair trips. Is cheaper than a repair job on regular transmitter.
With a few of these buttons your repair man is always prepared to fix a faulty transmitter on the spot.
Made for both magneto and common battery. Specify which is desired.


Patent Allowed

Price $1.00 per button

Discount for quantity. Order one or a few and try them. Catalog ready for you, describing this and other specialties.

Skinderviken Telephone Equipment Co.
2136 N. Clark St., Chicago, Ill.

McROY CAMP CONDUITS

Salt-glazed · Burned Clay

The standard for efficiency

Send for handbook on electrical conduits

NATIONAL FIREPROOFING COMPANY
Pittsburgh Pa.

PAUL H. WOODRUFF, Editor
Monadnock Building, CHICAGO

New York Office, 1022 Longacre Building
Forty-second St. and Broadway
Telephone Bryant 7030

This publication is free and independent of all business or house connections or control. No manufacturer or supply dealer, or their stockholders or representatives, have any financial interest in Telephone Engineer or any voice in its management or policy.

Entered at Chicago Post Office as Second Class Mail Matter

Telephone Engineer

WITH WHICH IS CONSOLIDATED
The Western Telephone Journal
ESTABLISHED 1902

PUBLISHED MONTHLY BY
ELECTRICITY MAGAZINE CORPORATION
MONADNOCK BUILDING, CHICAGO, ILL.
Telephone: Harrison 3014—All Departments

NOTICE TO ADVERTISERS

Changes of advertising copy should reach the office of publication not less than ten days in advance of date of issue. Regular date of issue, first day of each month. New advertisements will be accepted up to within five days of date of issue, but proof of such advertisements cannot be shown in advance of publication.

SUBSCRIPTION PRICE
Per Year $2.00
Canada $2.50
Foreign 3.00
Single copy 20

FOR SALE AT ALL NEWS STANDS

NOTICE TO SUBSCRIBERS

REMITTANCES — Remittances should be made by check, New York draft or money order, in favor of TELEPHONE ENGINEER. Foreign subscriptions may be remitted direct by International Postal Money Order.

CHANGE OF ADDRESS—The old address should be given as well as the new, and notice should be received two weeks in advance of the desired change.

If Your News Dealer Will Not Supply You—Please Notify Us

VOL. XIX CHICAGO, MAY, 1918 NO. 5

Make It All Measured Service

A FRIEND of ours reported the other day that he had discovered the old fashioned "public dining room," where the meat and potatoes and vegetables were put on the table en masse, so to speak, and the diner was invited to help himself, and to sing out if more was wanted. He found it in a town of fourteen thousand down in Indiana. He did not mention the price. We suppose it was a quarter. That used to be the standard rate, and any restaurant keeper who could afford to retain the old system would probably stick to the old price. Happy days!

That is what might be called the flat rate of eating. It is essentially the same as the flat rate of telephoning; except that a man's capacity for food is limited and his capacity for telephoning is not limited except by the number of calls that can physically be included in twenty-four hours. As a logical institution, therefore, the flat rate meal has the better of the flat rate telephone.

Detroit and Cleveland have received permission from their state commissions to put their telephone systems on a flat rate basis. While Cleveland's protest is rather mild, Detroit is making a most vigorous agitation against the ruling. The local newspapers are attacking the situation as though measured service were a final barbaric victory over the innocent people—proof of the inherent iniquity of the soulless corporation.

What eloquent disciple of witlessness started this campaign against the only reasonable system of selling service we do not know. It is, indeed, beyond our comprehension how any protest against measured service can be sincere. The flat rate system is really an imitation of the Chinese method of paying the family doctor by the year.

Reasonable telephone subscribers—which means a majority—rejoice in the coming of measured service, because it means that they have the advantage of the few unreasonable subscribers. The protest against the elimination of flat rate comes from those who wish to use the telephone continuously for business purposes at the expense of the "general average rate." In this peculiar class the newspaper offices rank high.

Every thinking man who uses his own telephone only for calls of a definite value will welcome the day when all telephone service is on a measured service basis, and when each user pays for what he uses.

* * *

Rates Ample; Materials Cheap; Companies Rich

THE other day the Indiana Commission had an unusual experience. It ran across an Independent telephone company whose record showed a remarkably consistent history of prosperity. The company seemed to be threatened with loss for the first time in its career, and asked for relief in the shape of higher rates.

Perhaps the astonishment of the commission was responsible for its utterance of a number of platitudes which, if they were intended to apply to the telephone business in general, were better left unsaid.

To paraphrase the commissions lecture briefly, it advised telephone companies to be pa-

triotic and patient; to forget the idea of paying dividends during the war, and to attend to maintenance out of their hoarded riches; to remember that telephone materials had not increased in price, like electrical and gas and railway materials, in spite of rumors to the contrary; in short, to dismiss any thought of remaining solvent while the big war was on. If those were not the words or the thoughts of the commissioners, at least a strong impression to that effect remained.

We have already, in previous issues, dwelt sufficiently upon the reasonable attitude of the administration toward the public utility problem, and the recommendations of the President to state authorities. At the time we recorded these events, we did not think it important that the administration communication failed to mention the telephone specifically. Now we see that it is necessary, when addressing authorities of a certain stamp, to mention specifically everything that is involved in the situation. The spirit of the occasion means nothing to them; they must have the letter.

If any Independent company has a hoarded fortune, we still think it would be better to put it into Liberty Bonds and arrange its present rates on a logical basis, regardless of past performance. However, we have no personal knowledge of such a company. Furthermore we don't believe there is any such animal.

The peculiar favor of providence that keeps telephone materials at their pre-war prices, while shooting everything else skyward, is also pleasant news. We know several thousand telephone companies whose managers could catch up on their sleep if they could discover the secret the Indiana commission claims to possess.

* * *

The Government Ownership Propaganda

IT did not require any gift of foresight to predict an increasing agitation for government ownership of telephones as the complexities of war work grew, and the present situation is not at all surprising. The only feature which has no special significance is the postmaster general's report, which is a perennial growth anyway and therefore loses what special appeal it might otherwise carry at this time.

Sincere workers for the efficiency of government effort in a time of unprecedented demand are convinced that the official task should be simplified rather than complicated by the addition of new and unnecessary duties. When the main business is war, obviously as much of the official attention as possible should be concentrated upon that object, and the conduct of civil affairs should be left to those experienced in them and able and willing to undertake them.

It is typical of such situations that the proponents of government ownership are displaying a marked tendency to exaggerate the facts in their possession, and to make statements which, to say the least, could easily be thrown into debate. The Hearst papers, for example, have carried "popular" editorials whose influence upon the uninformed public must not be underestimated because of their lack of logical foundation. Such an editorial carried, for example, the subhead, "The postmaster is vigorously pushing the thing, approved, of course, by the President." We are not yet aware that the President has ever approved government ownership of telephones anywhere.

We are glad to be able to say that no advocate of private ownership has yet descended to the use of false statements.

* * *

Introducing Our New President

Mr. Fred W. Schwamb, a capitalist, has been elected to the office of president and treasurer of the Electricity Magazine Corporation, which publishes TELEPHONE ENGINEER.

Mr. Schwamb's successful conduct of his own affairs enabled him to retire from active participation in business some years ago; and it is his purpose to devote a considerable share of his present time to the improvement of this publication and its companion properties.

PERSEVERANCE

By Leigh Mitchell Hodges

—Du Pont Magazine.

Perseverance is patience guided by purpose and propelled by human horse-power.
It plays no favorites.
With it poverty can be conquered and failure put to flight.
"Victory belongs to the most persevering," said Napoleon—and the man who proved this against him at Waterloo said, "Hard pounding, gentlemen; but we will see who can pound the longest."

When asked by a young man for a recipe for success, Bismarck replied: "You need three ingredients. The first is work. The second is work. And the third is work."

Perseverance is persistence in effort—keeping everlastingly at it with heart, mind and soul firm-set on the desired goal. It offers a free field, and for the man or woman who sticks, it holds out the highest rewards. The required qualities are daring, digging and discounting of doubts.

The common cause of failure is want of application. Each normal individual has within self the means of succeeding. Lack of sticktoitiveness is the father of failure. Yet so powerful is perseverance that when applied even to the most typical offspring of this parent, it can transform a corner-loafer into a corner-stone.

History bubbles over with brilliant examples of men and women who, thru perseverance, lifted themselves from unknown depths to heights of fame.

Without this quality Abraham Lincoln might have died as sheriff of Sangamon County, Illinois, and Thomas Gray, who spent twelve years on his "Elegy Written in a Country Churchyard," might never have got beyond the point of furnishing jingles to the local paper.

The person who thinks success a matter of luck or genius has another guess. Even Shakespeare, who began by holding horses in front of the old Globe Theatre, never could have reached the summit without perseverance.

The biggest and best thing about this quality, however, is its usefulness in the ordinary everyday, common-garden variety of life and labor. Just as the constant dropping of water will wear away the hardest granite, so continued effort will overcome any obstacle.

Old Dr. Johnson, sour as a crab-apple and superbly sane, emphasized this fact by saying: "He that shall walk with vigor three hours a day will pass in seven years a space equal to the circumference of the globe." This makes a man think.

What people have said about perseverance, interesting and inspiring as it may be, is not to be compared to what people can do thru perseverance.

Yes, I mean what YOU can do.
What you can do when you keep on after you have come to what may seem the limit of your powers, the end of your string.

And all perseverance means, in the last analysis, is keeping on. *However narrow or steep your path, it will pay you to personally prove this matter for yourself.*

The Minnesota Plan

A saving of more than $350,000 a year to telephone subscribers in Minnesota through the proposed unification of service by the Northwestern and Tri-State companies is shown by a preliminary survey made by the State Railroad and Warehouse Commission in advance of the hearing April 29 on the application for approval of the consolidation project.

The investigation has revealed also that competing telephone systems will continue in 12 Minnesota towns, Commissioner Fred W. Putnam said.

The bigger consideration for which the unification is advocated is that of the convenience to all subscribers who will be enabled to communicate with one another, regardless of which system serves each party.

The survey disclosed further that more than two-thirds of the telephone subscribers in the state now are patrons of the Northwestern company. That system in Minnesota now serves 174,133 company stations and 11,893 service stations, a total of 186,026 stations. The Tri-State company has 82,533 Minnesota subscribers, including 76,260 company and 6,273 service stations. Other competing companies serve 5,564 subscribers, on 5,157 company and 407 service stations. The duplicate stations include 22,754 having both Northwestern and Tri-State service and 335 with the Northwestern and other competing service.

Proposed transfers under the zone division plan will mean to the Northwestern company a gain of 37,738 stations in the northern zone to be assigned to it and a loss of 62,791 stations in the southern zone, or a net decrease of 25,053 subscribers in Minnesota. To the Tri-State company and its subsidiary companies the result will be a gain of 54,962 subscribers in its southern zone and a loss of 52,677 in the northern zone to the Northwestern company, a net gain of 2,285 stations in the state.

The statement showing the towns in which competitive service will continue and the number of subscribers affected in each instance, follows:

Town.	Service.	Telephones.
Breckenridge	Northwestern Telephone Exchange Co.	68
	Breckenridge Telephone Co.	574
Goodridge	Eastern Development Telephone Co.	68
	Red Lake-Eastern Marshall Co.	27
Granite Falls	Northwestern Telephone Exchange Co.	50
	Granite Falls Telephone Co.	567
LeSueur	Northwestern Telephone Exchange Company	255
	Farmers Co-operative Telephone Co.	506
Lonsdale	Star Telephone Co.	72
	Webster Farmers Co-operative Telephone Co.	114
New Ulm	Northwestern Telephone Exchange Co.	1,985
	New Ulm Rural Telephone Co.	85
Northfield	Northwestern Telephone Exchange Co.	1,138
	Northfield Telephone Co.	356
Redwood Falls	Northwestern Telephone Exchange Co.	35
	Redwood Falls Electric Telephone Co.	475
Sleepy Eye	Northwestern Telephone Exchange Co.	52
	Sleepy Eye Telephone Co.	689
Wabasha	Dwelle Telephone Co.	429
	Greenfield Farmers Telephone Co.	216
Webster	Webster Farmers Co-operative Telephone Co.	290
	Star Telephone Co.	62
West Concord	Mutual Telephone Co.	448
	West Concord Farmers Telephone Co.	290

The zones will be divided by the northern boundary lines of Washington and adjoining counties west of Yellow Medicine county. The Northwestern company will continue to operate through toll lines extending from Minneapolis and St. Paul southward through Red Wing, Wabasha and Winona to La Crosse, eastward to Wisconsin, via Hudson, southward into South Dakota, via Mankato and Worthington, and from Granite Falls, via Marshall and Pipestone.

The Tri-State company asks permission to acquire all the property, including rural lines, franchises and right-of-way, and the established business and good will of the Northwestern company and its subsidiaries in the following cities and villages:

St. Paul,
St. Paul Park,
White Bear,
Bird Island,
Lamberton,
Olivia,
Renville,
Tracy,
Owatonna,
Austin,
Faribault,
LeSueur,
Northfield,
Mankato,
North St. Paul,
Stillwater,
Savage,
Granite Falls,
New Ulm,
Redwood Falls,
Sleepy Eye,
Windom,
Albert Lea,
Eagle Lake,
Grenville,
Madison Lake,
Red Wing,
Witoka.

This company plans also to buy and operate the lines of the Standard Telephone company in Preston, Caledonia and other towns in Fillmore and Houston counties.

The Northwestern company is to acquire the Tri-State exchanges and lines in Minneapolis and these additional places:

Badger,
Barnum,
Bloomington,
Braham,
Brainerd,
Brook Park,
Cambridge,
East Grand Forks,
Excelsior,
Foley,
Graceville,
Grandy,
Greenbush,
Hinckley,
Isanti,
Lindstrom,
Litchfield,
Milaca,
Moose Lake,
Mora,
North Branch,
Ogilvie,
Ouamia,
Ortonville,
Pine City,
Princeton,
Rush City,
Thief River Falls,
Wahkon.

The Northwestern is to acquire lines serving Hopkins, Robbinsdale, Columbia Heights and St. Louis Park from switchboards located in Minneapolis; Grasston from Braham and Barrows, and Merrifield from Brainerd switchboards.

The Northwestern is to buy also the majority capital stock and other holdings of the Tri-State company in these companies: Becker-Mahnomen Telephone Co., operating exchanges at Detroit, Callaway, Ogema and Mahnomen; Zenith Telephone Co., operating exchanges at Duluth, Cloquet and Carlton, with exchange service in Proctorknott from the Duluth board; Stevens County Telephone Co., with exchanges at Morris, and the Roseau Telephone Co., with exchange at Roseau; Clover Belt Telephone Co., operating exchanges at Sandstone and Bruno.

Included in the proposed purchases of the Northwestern company all the toll lines of the Tri-State company in the northern zone, together with the toll exchanges at St. Cloud, Crookston, Moorhead, Willmar and Appleton.

Hearty approval of the consolidation order affecting both the Northwestern and Tri-State telephone companies was given April 6 at a meeting of the board of directors of the Minnesota Independent Telephone Association at the office of the secretary, E. C. Kast, 922 McKnight building, Minneapolis.

"Such consolidation would have a beneficial effect on the smaller independent companies throughout the state because of the economy in plant operation it would have," reads a portion of the resolution passed. "The order will meet with the approval of the public throughout the state as it will reduce to them the necessity of a dual telephone installation."

Manual, Automatic, or Semi-Automatic?

The United States Bureau of Standards Reports on the Washington Situation

A Discussion of the Relative Advantages and Limitations of the Manual, the Semiautomatic, and the Full Automatic Systems of Telephony, Their Relative Adaptability to Prompt and Economic Enlargement, and the Practicability of Physical Connection Between Automatic, Semiautomatic, and Manual Systems, Especially with Reference to Long Distance Working. Prepared by Dr. F. A. Wolff and Mr. G. S. Macomber, Engineers of the United States Bureau of Standards, at the Request of the Postmaster General.

LAST month we presented the full text of the reply sent by Postmaster General Burleson to the Senate resolution in reference to the proposal to federalize Columbia wires. Mr. Burleson followed his report with a request to Secretary of Commerce Redfield for a study of the Washington situation by the engineers of the Bureau of Standards. Dr. S. W. Stratton, director of the bureau, accepted the task under date of March 18; and on April 6 he delivered to the postmaster general a forty-page report prepared by Dr. F. A. Wolff and Mr. G. S. Macomber, engineers of the bureau. Messrs. Wolff and Macomber acted as technical advisers to the Public Utilities Commission of the District of Columbia during the hearings, at the request of various citizens' associations.

The last paragraph of Dr. Stratton's letter of transmittal, accompanying the Bureau of Standards report, says:

"The question of public ownership has, naturally, not been considered."

Part I of the report, dealing with "an analysis of the telephone situation as developed in the hearings before the commission," goes into the measures of relief asked by the telephone company and the expense and equipment data upon which the request was founded. We will not present it here, despite its great interest and value, because we believed Part II of the report to be even more significant. We quote, however, a paragraph or two from Part I as bearing directly on the subject of this paper:

AVAILABILITY OF AUTOMATIC APPLIANCES.

Besides the full automatic and the semiautomatic central office equipment (the latter being sometimes referred to as automanual or semimechanical) discussed at the hearings, there were also mentioned several automatic appliances which may be superimposed on manual equipment as follows: Automatic "listening in" of the operator, automatic "cutting out" of the operator after completing a connection, instantaneous recall, call distributing systems to equalize the load among operators, automatic trunk selection and release, and overflow switchboards.

It was developed on cross examination that none of the features enumerated above had been applied in Washington or were considered available for the relief of the local situation, although several of them have been applied elsewhere by the Bell Co., notably in Newark, N. J., where semiautomatic equipment has been installed in three central offices, and in Wilmington, Del., where a call distributing system is in process of installation.

It was furthermore brought out that a great amount of development work along these lines is in progress in the Western Electric Co.'s laboratories, and that the American Telephone & Telegraph Co. has also acquired by purchase the right to manufacture and use practically all types of such equipment covered by United States patents held by other companies.

The report which follows constitutes, in the words of Postmaster General Burleson, "a discussion of the relative advantages and limitations of the manual, the semi-automatic, and the full automatic systems of telephony, their relative adaptability to prompt and economic enlargement, and the practicability of physical connection between automatic, semi-automatic, and manual systems, especially with reference to long-distance working."

A. THE RELATIVE ABILITY OF THE THREE SYSTEMS TO HANDLE TRAFFIC

The relative ability of the different types of central office equipment to handle traffic is in the end an economic question, for if the questions of capital, depreciation, taxes, and fixed charges, as well as operating expenses, are excluded from consideration, any system can obviously be designed to meet any given volume of traffic originating from any given number and grouping of subscribers.

In order to make a detailed comparison from the economic stand point complete traffic and operating data are required. For the manual system these include:

(*a*) The classes of service.
(*b*) The number of subscribers in each class.
(*c*) The average usage of each class.
(*d*) The average number of originating calls for each hour of the day, and especially for the "busy" hour.
(*e*) The percentage of incomplete calls.
(*f*) The percentage of trunked calls.
(*g*) The particular type of central office equipment under consideration—this determining the amount of labor required to complete a connection of a given type.
(*h*) The number of "work units" corresponding to each type of call.
(*i*) The normal load in terms of "work units" representing the normal capacity of the average operator.
(*j*) The operating efficiency of the operators as related to their adaptability, skill, training, and experience.
(*k*) The ability of the operator to handle minor traffic peaks of short duration.
(*l*) The value to be assigned to "team work," which defines the abilty of adjacent operators to assist one another in case of need.
(*m*) The allowance, if any, to be made for unusual conditions affecting the efficiency of the operators.
(*n*) The requirements for handling the toll and long distance calls.
(*o*) The requirements for handling pay station service, as also information, record and complaint service.

Assuming for simplicity an exchange system having a given number of central offices already located, the above data make it possible to determine the number of A and B switchboard positions, a 25 per cent allowance being usually made for growth, the number of additional positions for toll, long distance, and special service, the floor space requirements, allowance being made for the terminal equipment; power plant; rest, lunch, and retiring rooms for the operators; quarters for the operators' school, etc. In making the original plans the size of the building and the lot on which it is placed involve other factors, namely, the ultimate number of subscribers' lines to be connected to the office, and the traffic. At the present time the number of lines is limited to 10,500 per office. The above data also determine the number of operators, supervisors, chief operators, and other central office employes, as well as the number of employes engaged in central office maintenance.

For automatic systems similar data are required, but obviously those factors relating to the efficiency of the operator and the work units corresponding to the different types of calls are eliminated. However, since some service, such as toll, long distance, pay station, information, and complaint, will still be handled by manual operators, allowance must be made for the operators, equipment, and floor space required. In addition, the cost of this equipment, the annual carrying charges thereon, together with operators' wages, must be taken into consideration.

The space requirements obviously depend upon the particular type of automatic equipment under consideration. This, compared with the space requirements for manual operating, is considerably less for all hitherto successful types, the saving amounting to from one-third to one-half or more.

For semi-automatic systems added factors must be introduced on account of the employment of operators, the number of which is, however, very much smaller than in manual practice, since the operator in semi-automatic working (when unessential supervision is eliminated) is merely required to receive the call and set up the same on a keyboard, similar to that employed in commercial adding machines, while at the same time she is repeating the number for the sake of accuracy to the calling subscriber. Some idea of the performance of semi-automatic operators may be obtained from a report for the Lima, Ohio (automanual), Telephone and Telegraph Company, kindly placed at the disposal of the bureau by Mr. E. E. Clement, the inventor of the basic principles there employed. The Lima system is one serving 9,228 subscribers, 4,600 lines being in service. In December, 1917, on the 10th day of the month, the total number of originating calls rose to over 144,000 for the day, an increase of about 70 per cent from the normal load for the month. This is equivalent to a total annual originating traffic of almost 52,000,000 calls, which incidentally represents about two-thirds of the annual originating traffic from somewhat over 60,000 subscribers' stations in Washington during the past year. Notwithstanding the suddenness of the increase, which came on over night as a result of the recognition of a serious coal scarcity in the State, this enormous load was handled without serious embarrassment to the company, and, most remarkable of all, the entire load was handled from fifteen operators' positions, the average number of calls handled per operator per hour between the hours of 9 a. m. and 2 p. m. being 813, the individual load ranging for one operator as high as 1,028 calls in one hour. The total number of employes, including the chief operator, information and trouble clerks, relief operators, and the matron, being forty-two. This may be compared with Washington, where the total number of operators, counting, however, also the number engaged on toll and long distance work was considerably over 1,100, including 300 or more from out-of-town points to relieve the local scarcity resulting from the heavy government demands for additional clerical and other help.

There is very little reliable published information regarding the basis for estimating investment, carrying charges, operating expenses, space requirements, etc., of the different systems on the basis of an equal volume of traffic to be handled. It is, however, highly desirable that a detailed study of this sort should be undertaken as soon as possible. Under prewar conditions the basis of comparing original cost for manual, semi-automatic, and automatic, the latter being designed for a minimum 10 per cent trunking allowance, as adopted by the Automatic Electric Company, gave a ratio of 30 to 40 to 50, respectively. With such a trunking factor, however, a very largely increased calling rate over and above that for which manual systems are designed is furnished. As an example of the traffic-handling capacity of the equipment furnished by the Automatic Electric Company might be cited the following:

The Tri-State Telephone & Telegraph Company,
St. Paul, Minn.

Gentlemen: Believing that you will be interested in a record recently established by the secretary's office of the St. Paul Association of Office Men in making calls over the Tri-State automatic system:

Last week, in calling the members to advise them of the weekly luncheon—giving the name of the speaker, etc.—we found that in two hours we called 126 members, which means that each call was completed in a little less than one minute.

We know the Rotary Club and other local organizations have established speed records with the automatic, but doubt if any of them have bettered the above figures.

Very truly yours,
ST. PAUL ASSOCIATION OF OFFICE MEN,
By E. A. RUSSELL, Secretary.

While under normal conditions a detailed study might have to be undertaken to determine whether the substitution of automatic or semiautomatic equipment for existing manual equipment would "prove in" from an economic standpoint, under the abnormal conditions now prevailing in Washington, and likely to continue for some time, such an ivestigation seems superfluous. This conclusion is well supported by the proposal from the Chesapeake & Potomac Telephone Co. in its petition to the District Utility Commission to abolish flat-rate contracts.

In the hearings it was stated by the company that Washington was scheduled to eventually be placed on an automatic basis. After the hearings Mr. Sylvan was reported in the public press to have stated that the company was to enter upon an immediate program for changing the whole of Washington to an automatic basis. The obvious reason is the greater traffic-handling capability of the automatic system.

"When the war is over and medals are being handed out, a few of them ought to go to the Plant people in Washington."—The Chesapeake and Potomac "Transmitter."

B. QUALITY OF SERVICE.

General.—The quality of telephone service (aside from the intrinsic reproducing qualities of the apparatus, absence of cross talk, etc.) may be considered under the following headings:

Reliability.
Accuracy.
Speed.
Supervision.
Continuity.
Secrecy.

It has been and is the policy of the American Telephone & Telegraph Co. and of the associated Bell companies to regularly make certain service observations in each central office for the purpose of obtaining a measure of the quality of service. The results of these observations are recorded on standard forms, copies of which are forwarded for study and comparison to the traffic engineers of the American Telephone & Telegraph Co. The form used by the Chesapeake & Potomac Telephone Co. contains 63 different items arranged under 13 general headings or groups.

For present purposes these items have been rearranged and classified as per the chart, Table I.

Under the first six general headings are arranged factors which are dependent upon the performance of the operator, under the seventh heading are collected items which depend upon

the performance of the subscriber, and under the eighth heading are added various items peculiar to automatic and semiautomatic systems.

In the columns at the right of this chart are placed, under the heading, "Manual system," the corresponding averages obtained for all of the central offices in Washington for two different months, namely, January, 1916, as representing prewar conditions, and December, 1917, as representing the conditions for the month in which the hearings before the Public Utilities Commission were begun. In the adjacent columns headed "Semiautomatic system," and "Full automatic system," respectively, are placed designations indicating, respectively, that the corresponding factors are or are not present or of importance in these systems.

TABLE NO. I.—FACTORS REQUIRED FOR JUDGING SERVICE.

Key to Symbols.

v indicates a similar factor is to be applied, but its value is not given.
s indicates similar but very small factor to be applied.
0 indicates value of factor is zero.
• indicates no corresponding factor.

	Manual System.[1] Jan., 1816.	Dec., 1917.	Semi-automatic.	Full automatic.
I. OPERATING ERRORS.				
Originating calls.				
Calls affected by operating errors	2.3	4.7	v	•
Cut-offs	.3	.4	•	•
Connections to wrong lines	1.5	2.8	v	•
Connections to wrong party-line stations	v	v	v	•
Double connections	.4	1.5	0	•
Incorrect reports	.1	.3	•	•
Incoming trunk calls.				
Calls affected by operating errors	3.0	5.7	v	•
Cut-offs	v	v	•	•
Connections to wrong line	v	v	v	•
Connections to wrong party-line stations	v	v	v	•
Double connections	v	v	0	•
Incorrect reports	v	v	0	•
II. OPERATING IRREGULARITIES.				
Calls affected by operating irregularities	7.1	18.1	s	•
Improper repetition	1.9	4.6	s	•
Improper phraseology	2.8	10.3	s	•
Careless supervision	1.1	2.5	•	•
Operator impertinent or discourteous	.1	.2	s	•
Miscellaneous irregularities	3.3	8.7	s	•
III. SPEED ELEMENTS.				
Speed of answer to line signals.				
Average time to answer line signal	3.6	6.0	s	•
Line signals answered in over 10 seconds	3.3	13.5	s	•
Plug-ins one second or more previous to answer	1.1	4.1	s	•
Average time from answer to acknowledgment	v	v	v	•
Average time to answer by ring down trunk operator	v	v	v	•
Answers by ring down trunk operators over 10 seconds	v	v	v	•
Speed of report and connection.				
Busy flash back signals remaining on subscribers' lines over 10 seconds	v	v	•	•
Don't-answer intervals without report within standard time	v	v	•	•
Average time from acknowledgment to answer of called number. Local calls—seconds	20.0	v	v	•
Average time from acknowledgment to answer of called number. Direct call circuit calls—seconds	27.2	v	v	•
Average time from acknowledgment to answer of called number. Tandem call circuit calls—seconds	v	v	v	•
Average time from acknowledgment to answer of called number. Ring down trunk circuit calls—seconds	v	v	v	•
Speed of disconnect.				
Average time for operator to disconnect—seconds	v	v	0	0
Disconnection over 8 seconds	1.7	5.0	0	0
Average time to disconnect supervision—seconds	v	v	0	•
Disconnect supervision over 10 seconds	v	v	0	0
Speed of recall.				
Calls having attempts to recall operator	9.5	14.0	v	•
Attempts answered over 10 seconds	v	v	•	•
Attempts not answered. Subscriber hung up over 10 seconds	v	v	•	•
Attempts not answered. Cleared up over 10 seconds	21.0	42.8	•	•
Attempts included in above with improper flash	v	v	•	•
IV. VOLUNTARY SUPERVISION.				
Voluntary supervision intervals not supervised	v	v	•	•
Intervals improperly supervised—too long	46.4	58.6	•	•
Intervals improperly supervised—too short	13.8	9.8	•	•
V. CALLS NOT COMPLETED.				
Calls not completed on first attempt	16.7	27.6	v	v
Busy reports	9.7	15.7	v	v
Don't answer reports	1.4	1.4	v	•
Calls abandoned by subscribers	4.8	9.3	v	v
Calls not completed on first attempt—other causes	.8	1.2	v	v
VI. MISCELLANEOUS DATA.				
Calls with plant trouble or poor transmission	.0	.0	•	v
"My bell rang" reports	2.7	2.8	•	•
Calls with disconnect supervision	v	v	•	•
Line signals not answered. Subscribers hung up after 5 seconds	v	v	v	•
VII. SUBSCRIBERS' IRREGULARITIES.				
Calls affected by subscribers' irregularities	1.0	1.1	v	v
Subscriber calls for wrong number	1.0	.8	v	v
Subscriber fails to correct wrong repetition	.3	.4	v	•
Subscriber interference on two-party line	.2	.0	v	v
Cut-offs by private branch exchange attendants	v	v	v	v
VIII. FACTORS SOLELY APPLICABLE TO AUTOMATIC AND SEMIAUTOMATIC SYSTEMS.				
Errors due to automatic central office equipment	...	...	v	v
Errors due to subscribers' dial	...	...	•	v
Errors due to improper dialing	...	...	•	v
Errors due to incorrect dialing	...	...	•	v

[1] Factors given in per cent or seconds.

"Plant has been called upon to do more actual physical work than any of the other departments, and practically all of it in a tremendous hurry and under unusual and trying conditions."—"The Transmitter."

Reliability of equipment.—As regards any difference between manual, semiautomatic, or full automatic equipments of responsible make, there does not seem to be any material choice, providing that proper attention is given to current maintenance.

Accuracy.—With respect to accuracy, reference to the table will show that many of the elements which give rise to errors on the part of the operator, which are deemed to be of sufficient importance, are entirely lacking with automatic equipment and are, to a very large extent, eliminated with semiautomatic equipment. In the latter case, where the percentage of error is largely reduced, attention is called to the fact that in this system no B operator is required, the trunking being effected through automatic equipment, thus eliminating errors from this source.

On the other hand, with automatic and semiautomatic equipment there is a source of error, though very small, as shown from actual service observations, and in particular in the article on Machine Switching Telephone Gear, by F. R. McBerty, due to failure of the switches to respond correctly to the dial impulses. In well maintained systems McBerty's data show that they hardly exceed one-tenth of 1 per cent.

McBerty also describes results obtained in the case of offices not attended throughout the full 24 hours, and the results of special studies for periods during which there was no maintenance service, varying from 11 days to 6 weeks. Thus, with the maintenance of equipment withheld for 11 days during which 83,000 connections were recorded, a single fuse being removed from one switch to put it out of operation, the equipment gave satisfactory service throughout the period. While the percentage of errors (failure to obtain proper connections) was 0.27 per cent with ordinary maintenance, at the end of the test, the percentage of error had risen to only 0.57 per cent.

With the maintenance and repair suspended for a period of six weeks attention being confined to recording errors and cutting out switches observed as frequently producing errors the percentage of errors did not substantially increase, but at the end of the period of six weeks 12 per cent of the switches had thus been temporarily withdrawn from operation for cleaning or re-

pair. The switching service otherwise was satisfactory throughout. This may be compared with the Washington experience for January, 1916, or December, 1917, when the aggregate errors due to "cut-offs," "wrong numbers" and "double connections" amounted to over 4 per cent and 8 per cent, respectively.

In addition, a comparison should be made between the errors due to the subscriber when using the different systems: those encountered in manual working being contrasted with the subscriber dialing the wrong number through carelessness, or through trusting to memory in not looking up the correct number in the directory. This is likely not to be more common in automatic working than in manual working. Errors, particularly immediately after a change-over from manual to automatic, may be expected through improper dialing. For example, an incorrect number of impulses may be given in pulling the dial to a stop if the motion is not continuously in the proper direction. Such errors tend to become very infrequent after a short experience in operating the dial.

Summing up, it appears that, assuming the use of modern equipment of the automatic type properly maintained, the percentage of total errors to total calls will be less than in manual working, while the difference between automatic and semiautomatic working is likely to be small, since the error of the operator in understanding the number called is to some extent offset by errors on the subscribers part. In the case of semiautomatic, the percentage of error in setting up a call on a keyboard should be very small, particularly when judged in the light of the accuracy of tabulating results by the aid of an adding machine utilizing a keyboard of similar arrangement.

Speed.—In manual working the time element of importance is obviously not merely that required for the A operator to answer the calling subscriber, but rather that involved from the initiation of the call until the called subscriber's line is connected to the ringing generator. This is made up of various elements. These and the operations to be performed by the operator and the time required for so doing are copied below from McBerty's article already referred to:

For manual system.

(*a*) Observe a call signal and prepare to act.....1 or 2 seconds
(*b*) Take a plug and insert in jack.....1.5 seconds
(*c*) Receive an average number at an average speaking rate ..... 2 or more seconds.
(*d*) Repeat number for sake of accuracy.....2 seconds
(*e*) Carry plug from shelf to multiple field.....1.5 or more seconds.
(*f*) Withdraw two plugs .....2 or more seconds
Average time to switch through one operator.....8 seconds
Average time to switch through two operators.....15 or 20 seconds.

As shown above, the average time, under normal conditions, to obtain a connection through one operator is about 8 seconds, while for trunked calls involving two operators, 15 to 20 seconds are required.

In automatic systems the corresponding time element is that required for dialing the number selected. This depends on the average skill and intelligence of the telephone user and upon the design of the automatic equipment; that is, the speed with which the switches are designed to accurately follow the impulses received. In the case of the Automatic Electric Co. equipment, this has been standardized for a dial speed requiring a maximum time of one second for any digit, so that the time required to call a five-digit number should not average appreciably more than six seconds.

In the case of the semiautomatic equipment, corresponding time elements are involved with addition of (*a*), (*b*), (*c*), and (*d*) of the table above, though in order to make possible the carrying of very heavy loads by the operator the switching mechanism may be designed for higher speeds, as in the case of the apparatus made by the North Electric Co. and used in Lima, Ohio.

Such higher working speeds can not be utilized to full advantage in automatic systems on account of being limited by the normal speed at which the average subscriber would be prepared to dial the number desired.

Among the other time elements of importance is the time of recall, which represents the time required on the part of a manual operator to acknowledge an attempt on the part of a subscriber to initiate a second call immediately after having completed one.

Though the table above shows that it takes but a few seconds to remove the plugs required to establish a connection, in the busy hour the operator, particularly if overloaded or inexperienced, fails to remove the plugs for considerable periods, so that in order to initiate a new call the calling subscriber must flash the supervisory signal lamp. Corresponding difficulties will be encountered on the part of the called subscriber for initiating a call while the two lines are still connected. This frequently involves annoying delays, irritation on the part of the subscriber, and consequently affects, indirectly, the operator's capacity for handling calls. With both the automatic and the semiautomatic systems, as also with various improved types of manual equipment, the time of disconnect is practically eliminated; the mere hanging up of the receiver on the part of the calling subscriber automatically frees the connections, making it possible to immediately initiate another call.

Without instantaneous disconnect it would obviously have been impossible for a subscriber to make over 125 calls in two hours. This has been done and was described above under the heading, "Traffic handling capacity."

Supervision.—By supervision is understood the personal attention on the part of the operator in seeing that a connection is properly made and properly maintained during the period desired, and properly disconnected when the conversation is completed. It includes also making reports such as "The line is busy," in case the line of the subscriber called for is engaged; "Don't answer," in case the called party does not answer within a reasonable time, and in answering flashes representing attempts of the subscribers engaged in conversation to attract the operator's attention.

The American Telephone & Telegraph Co. and the associated Bell companies, have from the beginning laid especial stress upon the need of the personal element in telephony. In the early days of the art, where long and frequent delays in obtaining desired connections were the rule, there no doubt was an absolute need of this element. Since the calling subscriber could not see what the operator was doing, it gave him a sense of satisfaction, or at least lessened irritation at delays, to have the operator's assurance from time to time that everything possible was being done to establish the connection desired. In addition, poor transmission was also frequently encountered, so that it often became necessary on even relatively short toll connections for the operator to serve as a means of communication between the two subscribers by repeating what each wished to say to the other.

The development of the art has, however, reached the stage where a considerable part of such supervision might be advantageously eliminated. Even manual systems have been designed, and are in use, in which on local calls an automatic busy signal, such as is now given quite commonly for trunked calls, can be given to the calling subscriber, thus eliminating the necessity of the operator making a busy report. Another feature which may and has been added is the automatic "ring back" through which the calling subscriber is assured that the called party's bell is ringing by receiving a portion of the ringing energy in his own receiver. This eliminates the necessity of a report on the part of the operator that the called subscriber is being rung. In addition it has been found in automatic systems where this method is the rule that the called subscriber answers a call much more promptly on the average than in manual systems, a psychological reason being that he knows that the party calling hears his bell ringing. Further, this renders it unnecessary for the operator to report that the called subscriber does not answer since the calling subscriber, knowing the telephone habits of the called subscriber, hangs up his receiver after waiting a reasonable time for an answer without the necessity of a report.

The rebuilding of the Coast Guard line from the Maryland-Delaware boundary to the mouth of the Chesapeake was one of the big jobs handled by the C. and P. forces.—"The Transmitter."

Without any question, the telephone-using public has been largely educated to expect supervision and to regard it of value, although it has been shown that through the elimination of supervision an auto-manual operator can handle as many as 800 to 1,000 calls per hour. The Bell semiautomatic, or semimechanical equipment, as they prefer to call it, as installed in Newark,, N. J., is designed so as to provide for a continuance of supervision though at the expense of a very considerable reduction in traffic-handling capacity, as compared, for example, with the Lima, Ohio, auto-manual exchange.

Continuity of service.—One of the advantages claimed for full automatic systems which can not be made for any other is that continuous service is furnished without the attendance of an operator. This is of particular value in the case of smaller central offices as well as private branch exchange systems during hours when the traffic is light, such as at nighttime, Sundays, and holidays.

The feasibility of furnishing service under these conditions without an attendant has been fully demonstrated by actual experience. Mr. McBerty's experience has already been quoted.

Secrecy.—Absolute secrecy of telephonic communication is obviously something which can not be assured by any possible known means, since methods have even been developed for "listening in" without making direct connections to the telephone circuit to be guarded. However, this can only be accomplished by some one who has access to the central office equipment, including the terminal racks, or to the conductors forming the telephone circuits up to and including the subscriber's instrument. In the automatic system and in some types of the automanual system in which the operator after completing a connection is automatically disconnected (a feature which has been added to some types of manual equipment) secrecy, in so far as preventing any operator listening in, is assured. This is an advantage in decreasing the possibility of "leaks."

With regard to the manual systems the opportunity for "listening in" is very slight during the "busy hour," but may become of moment when the operator's load is light, particularly if supervision is relaxed. The opportunity for "listening in" is probably greatest in connection with manual private branch exchange systems carrying relatively light loads.

Additional features meriting consideration.—Among the features tending to improved service, shared equally by automatic and semiautomatic operation, is the increased promptness on the part of the called subscriber in answering his bell. This has already been referred to as being due to the fact that in the above systems an automatic "ring-back" is provided enabling the calling subscriber to satisfy himself that the bell of the called subscriber is ringing, a fact which is also known to the latter.

This feature can obviously be applied to manual systems, and this has actually been done in some instances.

Another feature which has apparently manifested itself in all cases after conversion from manual to automatic or semiautomatic is due to the reduction in the average duration of a conversation, seemingly explainable on the basis of the relative ease with which another connection, if found necessary, may be obtained.

Among the more recent added features of automatic systems, "conference working" should be referred to. This makes it possible for any reasonable number of stations, by dialing the same number, to be simultaneously connected up to one another, any additional subscribers being automatically excluded. This feature has been found of considerable advantage, particularly in connection with automatic private branch installations in commercial and industrial establishments. Obviously it would have an equal value in connection with Government work.

C. THE RELATIVE NUMBER OF EMPLOYES REQUIRED FOR OPERATION AND MAINTENANCE FOR MANUAL, SEMI-AUTOMATIC AND AUTOMATIC SYSTEMS.

With regard to the number of operators required, not over one-fourth as many should be needed in full automatic systems as in manual systems, while an additional number, which may be estimated at one-fourth or less of the operators displaced by automatic, will be required for semiautomatic or automanual operation.

The work necessarily performed by operators, with full automatic operation, consists in the handling of information, complaint, toll, and long-distance service (as well as farm line service where this must be provided for). In addition pay station service is ordinarily handled in automatic systems through special operators who complete the connection desired by the aid of a dial or keyboard. The number of these classes of operators is obviously dependent upon the volume and character of the traffic to be handled, as also on the capacity of the operators for handling calls, and can therefore be satisfactorily estimated if the required data be available.

The number required for semiautomatic or automanual operation depends upon the design of the automatic equipment as well as upon the value and importance assigned to "supervision." If the latter is reduced to the minimum by eliminating all work on the part of the operator which is not really essential, the number required to handle even a large volume of traffic may be reduced to less than one-fourth the number required in manual work. Thus, while in Washington the number of local operators was approximately 860 and the total originating traffic 90,000,000 calls, in Lima, Ohio, under automanual operation, a load two-thirds as great was handled by 15 operators' positions, the total number of the employees in the operating department being 42, including 1 information operator, 1 operator for changed number and reverting calls, 1 chief or supervisory operator, 1, or at times 2, for handling the traffic originating from two or three hundred farmer subscribers, 1 matron, and 3 relief operators. In the automanual system and in semimechanical systems in general the number of operators is reduced to a minimum since the call distributing feature, by means of which the load on the operators is equalized by automatic means, is readily applied. It is therefore only necessary to provide a sufficient number of operators at all times to handle the traffic demand, the operators positions not needed being thrown out of service by means of a switch, thus concentrating the calls on a smaller number of positions. In the hours when the traffic is light one operator may therefore easily handle the entire load of a good-sized office from a single position. In manual working it has not been found practicable to reduce the number of operators during such hours to anywhere near this extent on account of the fact that the subscribers' signal may appear on any of the A positions of the board, thus necessitating its being constantly patrolled.

With regard to maintenance, it is difficult to arrive at any figures of general applicability. Each system under consideration must be separately investigated if reliable results are sought.

TABLE NO. II—MAINTENANCE LABOR ACCORDING TO F. R. MCBERTY.'

	Exchange—										
	A.	*B.*	*C.*	*D.*	*E.*	*F.*	*G.*	*H.*	*I.*	*J.*	*K.*
In service	1905	1910	1910	1910	1911	1912	1909	1914	1915	1915	1915
Type	Full.	Full	Full.	Full.	Full.	Semi.	Semi.	Full.	Semi.	Semi.	Semi.
Lines	13,500	2,000	5,000	750	2,300	3,150	450	700	960	780	6,500
Call rate	....	4.5	4.5	3	10	12	22	....	2	10	3
Error, per cent.	5.4	....	5	17	5.3	....	.25	....	....	.01	.37
Man-hours per line per year	6.7	6.3	3.2	12.6	11.5	5.4	6.9	6.1	5.5	2	5.2

Again, the number of employees required for this work will obviously depend upon the standard of maintenance set. This should be high if the quality of the service is regarded as being of prime importance. As a result of long experience with its automatic equipment under actual operating conditions, the Automatic Electric Co. has systematized this work and has devised a routine for testing and inspection in order to practically eliminate errors due to defects in the central office equipment. The great majority of potential troubles are thereby detected in their incipient state, and therefore before they are encountered by the subscriber. Even with such a routine, the number of maintenance employees is not excessive. According to actual data supplied by the company, the number of lines per maintenance employee is at least 600 under average conditions.

These figures are very much more favorable than those quoted by Mr. F. R. McBerty, who has been prominent in the development of automatic apparatus for the Bell system. In an article on machine switching gear, published in the *Journal* of the (British) Institution of Electrical Engineers, volume 55, page 265 et seq., he states:

"COST OF MAINTENANCE OF AUTOMATIC AND SEMIAUTOMATIC EQUIPMENT.

"As in the earlier history of the conversion of central office equipment from the magneto to the central-battery system, so in the conversion of central battery to machine-switching systems, the difficulties and expenditures actually experienced turn out to be less important than anticipated, and show a substantial diminution as the result of progressive improvement in manufacture and in practice. The early automatic exchanges required the attention of men in such numbers and of such skill to keep the equipments in good working order that their wages largely or quite counterbalanced the savings in operators. Experience with modern equipments demonstrates that the maintenance force need be hardly more numerous or more skillful than that required for manual equipment of equal size; while the faults requiring maintenance are of such a nature as to warrant the expectation of still further reductions in staff.

"The expenditure in wages constitutes the main item of maintenance expenditure; those for materials and replacing parts are practically negligible.

"The labor of maintaining certain typical automatic exchanges is shown in Table II, expressed in man-hours per line per year.

"These examples have been selected as typical from amongst a considerable number because of the fairly accurate and complete data available with respect to them.

"The year is estimated at 313 days to bring all examples to equality with certain equipments in which there is no maintenance on Sunday—excepting in the case of office H, calculated for 12 months from data of one month. The number of lines given is that of lines actually in operation. In all cases, except offices G, H, and I, the number of man-hours cover the time of maintaining the switches only, excluding time spent on power plant, distributing frames, and manual switchboards. The times given for exchanges G and I include the maintenance of the power plant and manual portions of the equipment, while that given for office H includes the work on manual toll switchboards but not on power plants.

"The errors noted for exchanges A, C, D, E, and G were observed by standard service tests from substations; those for offices H, I, J, and K were observed by tests and observations at the main distributing frame.

"Offices A and F, inclusive, are rachet-driven equipment, while offices G to K, inclusive, are power-driven.

"Offices A, B, C, G, and K were operated by telephone companies, while offices D, E, F, H, I, and J are operated by postal administrations."

* * *

THE RELATIVE ADAPTABILITY OF MANUAL, SEMI-AUTOMATIC AND AUTOMATIC CENTRAL-OFFICE INSTALLATIONS TO PROMPT AND ECONOMICAL ENLARGEMENT.

Regarding adaptability for prompt and economical enlargement of central-office equipment, it is somewhat difficult to make a fair comparison of the inherent advantages of manual, automatic, and semiautomatic systems in general, because in the equipment actually available at present this feature has been taken into account in some systems much more than in others.

The manual system has a distinct advantage in that it has been used longest in the well-standardized form and is now in greatest production.

On the other hand, the automatic system has two distinct advantages:

First. Since the equipment is assembled in the factory in such a way that a considerable part of the wiring is completed before shipment, and since the switches are assembled in groups which correspond, in a way, to the units of a sectional bookcase, it has been found unnecessary to send installers from the factory except for new work or very large additions which the staff of the operating company is not able to handle to advantage.

Second. There is a possibility of introducing a subexchange rather simply in any desired locality. For example, if there is a sudden demand for several hundred lines in a portion of the city where there are a few private lines running it is possible to convert these lines into trunks and use them to operate a subexchange placed at a convenient point in the locality. This saves the very expensive process of running a large number of lines to the nearest city exchange.

With regard to semiautomatic and automanual systems in so far as it is merely a question of making provision for handling an increased volume of traffic well within the limits of capability of the automatic switching equipment provided, this would involve only the addition of the required number of operators' work benches, the original cost of which should not be high and the installation of which should not involve serious difficulties.

With regard to the enlargement of manual offices, consideration must also be given to the fact that the central-office equipment, and therefore the space requirements, depend not only on the number of stations but also on the traffic to be handled, particularly that during the busy hours of the day as well as upon the number of calls of the average type which can be handled by the average operator. This has frequently led to the abandonment of an office or the establishment of additional offices before the office has grown to its normal ultimate capacity. In order to provide for this contingency, it is not uncommon in the larger cities to find provision made for such growth in the design of the central office buildings by making allowances for the installa-

tion of two separate central-office equipments in the same building, incidentally adding to the operator's load through the necessity of additional trunking requirements.

* * *

THHE PRACTICABILITY OF "PHYSICAL CONNECTION" BETWEEN AUTOMATIC OR SEMI-AUTOMATIC SYSTEMS AND MANUAL SYSTEM, ESPECIALLY WITH REFERENCE TO LONG-DISTANCE WORKING.

In accordance with its letter of December 19, 1913, addressed to the attorney general, in which it was agreed to make prompt arrangements whereby the public using telephones not operated by the Bell system could secure toll service over its lines, the American Telephone & Telegraph Co. has quite generally made physical connection with competing systems, many of them operating with automatic equipment, among which may be mentioned the system of the Tri-State Telephone & Telegraph Co. of St. Paul and Minneapolis; Harrisburg, Pa., Lincoln, Nebr., Portland, Ore., and Buffalo, N. Y., the latter recently taken over by the New York Telephone Co.

The extent to which this has been done may be judged from the last annual report of the American Telephone & Telegraph Co., dated December 31, 1917, in which are shown 3,444,148 stations belonging to connecting companies (many of which are competing locally with the Bell) as compared with a total of 7,031,530 stations owned and operated by the American Telephone & Telegraph Co.

The whole question raised under this heading can be dismissed by quoting from the record of the hearings before the California Railroad Commission on the proposed merger, since carried out, of the Los Angeles properties of the Pacific Telephone & Telegraph Co., a Bell company, of which the franchise was expiring, and the Home Telephone & Telegraph Co., an Independent company, operating an automatic system:

"Both the Home Co. and the Pacific Co. insist that there is no inherent operating difficulty in connecting up an automatic and a manual system, and they further insist that the service over such consolidated system will be entirely satisfactory.

"Mr. Leo Keller, chief engineer of the Home Co., testified that the service which the Southern Co. proposes to give will be the same thing, except on a larger scale, as the service which the Home Co. has itself been giving between its automatic and its manual subscribers. He testified that, with the exception of a delay not exceeding two or three seconds in connection with certain calls under the proposed consolidation, the service which will be rendered by the Southern Co. will be equally as good as the service which the Home Co. has been rendering in Los Angeles. Mr. Keller testified that although he preferred the automatic system and believed that the telephone development of the future lies more along the lines of automatic service than of manual service, he believed that by reason of the large expenditures which it would be necessary to incur at the present time to convert the entire Pacific system in its Los Angeles exchange into an automatic system it would be better to adopt the plan of consolidation worked out by the Pacific Co. and the Home Co., hereinbefore explained."

* * *

AN ANALYSIS OF THE METHODS PROPOSED FOR IMMEDIATE AND FOR PERMANENT RELIEF OF THE LOCAL TELEPHONE SITUATION, INCLUDING COMPARATIVE INVESTMENT DATA, MAINTENANCE AND OPERATING EXPENSES.

A. THE COMPANY'S METHOD AS OUTLINED IN THE HEARINGS.

The method which the company has now under way for the relief of the situation, is the development of the present plant and by its present methods. No distinct formulation of the method as a whole will be attempted, as nearly all of the essential data disclosed in the hearings have already been given above in the analysis of the present telephone situation.

It would seem that this method is now considered unsatisfactory by the company itself. Mr. Sylvan announced through the Washington press on March 14, 1918, that plans were under way to put the whole system on an automatic basis, saying that "within two years, possibly 18 months, it is hoped the Washington telephone system will be entirely automatic."

In view of this radical change in the plans of the company mention will be made of only a few of the more important considerations of the plan outlined in the hearings.

In addition to the advantage of greater simplicity of the equipment which the manual system of telephone operation possesses, the following advantages should be taken into account in considering this plan:

First, it would necessitate no change of methods of procedure from that to which the organization of the company is accustomed.

Second, the physical disturbances due to the necessary readjustments will be less than would be required if more radical changes are made.

Third, the telephone-using public, and particularly the officers of the Government, are used to the manual system of operation, and a continuance of the present system would obviate the change of telephone habits of users.

On the other hand, there are serious disadvantages of the plan as outlined in the hearings.

First, difficulties of securing operators under the present labor situation is almost certain to continue.

Second, with the growing demands of the Government for telephone service, and with the relatively smaller traffic-handling capabilities of the manual system, the quality of service is likely to remain poor, unless still greater outlays in capital and operating expenses are made.

Third, no provision is made for the equitable allocation of the operating expenses and capital accounts chargeable, respectively, to the Government and to the general public.

Fourth, the operating expenses have already mounted to an unprecedented figure and the trend is still upward. Comparing the values of 1916 with the estimated values of 1918 operating expenses per station have increased as follows: Maintenance, $3.57 to $5.96; traffic, $5.40 to $17.22; total operation, $24.04 to $39.91.

Fifth, the outlay of the capital involved is very large. Again comparing December 31, 1916, with the estimated values for December 31, 1918, the total capital has increased from $6,800,000 to $11,100,000, a total increase of over $4,300,000. Of this amount $2,500,000 is estimated for 1918.

Sixth, this large increase of capital raises a most formidable question of amortization and obsolescence, particularly in reference to the large capital outlays in central-office equipment and private branch exchange equipment to meet the emergency conditions, a considerable fraction of which will be lost when the company's contemplated change to full automatic operation is made.

B. NEW PROPOSALS WHICH MAY BE SURMITTED BY THE COMPANY.

No details are available regarding the company's plans with respect to the introduction of semiautomatic and later full automatic equipment or regarding any plan under consideration.

No proposal has thus far been received regarding the relief of the local situation by the aid of semiautomatic or automanual equipment, although efforts have been initiated to obtain definite proposals and suggestions. In case such proposals are received they should obviously be given full consideration, particularly as semiautomatic working would ordinarily be used during transition periods when one part of a telephone system is operated manually while the rest of it is operated by full automatic equip-

ment as would seem to be the case for any feasible method of adequately and promptly relieving the local situation.

ANY OTHER METHODS.

In considering any method of temporary relief for the local situation and for meeting the necessary Government needs, we have kept in mind that the time element is of the highest importance, not only from the standpoint of service but also in view of the piling up of operating expenses and investment charges resulting from large additions to plant being made. Obviously it was therefore necessary to consider the feasibility of utilizing equipment for the purpose in mind from whatsoever source obtainable, whether manufactured by the Western Electric Co., or by Independent manufacturers.

A study of the local traffic situation indicates that relief from congestion is necessary at three points at least, viz:

1. At the so-called "War Board," a very large private branch exchange having an ultimate capacity of eight or ten thousand lines and already serving 3,000 or more stations.

2. In the Main central office of the company to which the Government trunks from the "War Board" and the other private branch exchanges of the Government are connected. In the Main exchange is also installed the so-called Interdepartmental board, interconnecting the Government private branch exchanges by tie lines, thus handling the intercommunicating business between the different Government bureaus and departments. Most of the individual line service of the Government is also handled by the Main central office.

3. In two of the central offices of the company, North and Columbia, which serve the bulk of the residence subscribers, especially those taking flat-rate service.

Plan for securing prompt relief.—The traffic handled by the War Board is largely intercommunicating, providing, as it does, for handling the business between the various branches of the War Department and the other Government establishments engaged in war work. As already stated in this report, hundreds of outlying stations are directly connected with the War Board by extension lines in order to avoid the delays and annoyances which otherwise would have been encountered in the Main central office. This involves, on the other hand, corresponding rental charges for the extension lines required.

1. Relief for the intercommunicating traffic in the "war" group could be furnished according to estimates submitted by the Automatic Electric Co. within four months by the installation of full automatic equipment including, of course, subscribers' instruments provided with dials. At the same time this step would certainly relieve to some extent any scarcity of operators in the Government service, since a reduced number of operators would be able to handle the outgoing and incoming traffic from other Government boards and the company's central offices.

2. Installing a similar equipment in the Main central office, or, if no space be available there in a suitable location elsewhere, would make it possible to interconnect the Government departments, bureaus, and independent establishments now served through the Interdepartmental Board with each other and with the War Board, thus making it possible to dial from any station connected with the War Board to any other automatic station connected to that board, as also to obtain direct connection without the aid of an operator to any of the Government trunks, tie lines, or direct lines which may be connected to the automatic installation in Main.

Additions to this automatic board in Main would enable it to handle in the above manner all the Government lines or as many as desired now entering the Main exchange in the manner above described. This would relieve the Main office of this Government load which, with the War Department load, must form a considerable part of the total. In so far as outlined above, the plan would enable all direct lines having stations equipped with a dial to automatically secure connections to other automatically equipped stations, while by the addition of a dial or automatic keyboard at each of the positions of the private branch exchanges of the Government connections desired from any station connected to these boards with any automatic station of the system could be completed by the local private branch exchange operator through direct dialing. The private branch exchange operator would also be enabled to complete a connection as far as the operator of any other of the manual private branch exchanges forming part of the system, the call being completed in the usual manner by the second private branch exchange operator.

Outside connections to stations connected to the company's central offices could be obtained by the addition of a suitable number of trunks to the company's boards in the various central offices adequate for the efficient handling of the volume of such traffic so that by direct dialing of a single digit from any station of the system connection would be established with an A operator in any of the company's central offices.

Incoming calls from subscribers not forming part of the system would be most advantageously handled as follows: Such a subscriber, on removing his receiver from the hook, would signal his A operator as usual, and on asking for a station connected with the automatic system, his call would be extended to one of a number of special operators through suitable trunks or tie lines to a receiving cabinet or its equivalent, so arranged that incoming calls can be extended to any automatic station by dialing or setting up the call desired on a keyboard.

Obviously, automatic private branch exchanges would be installed in the various Government departments, bureaus, and independent establishments, as also at the Capitol, the order of installations being determined by the volume and importance of the business transacted.

This would convert the whole Government system to automatic for intercommunicating purposes, the only calls requiring an operator being incoming information calls from parties not knowing the particular individual or branch of the establishment with which communication is desired. This is provided for by assigning a number to each local automatic system, so that if this particular number is dialed an information operator who would complete the connection would be obtained.

If for any purpose it is desired to employ an operator for outgoing calls this can be arranged for in the usual manner, so that by dialing zero from any station on the Government system the operator can be obtained.

The gradual change over to full automatic working of the whole Government system could therefore be accomplished by installing automatic switching equipment in the form of local automatic subexchanges as needed in the order of the importance, provisions for direct dialing by the operator at manual private branch exchanges not yet replaced being provided for in the meantime.

As one of the results which would directly follow from the program outlined above a considerable number of extension lines to stations not located in the same building as the private branch exchanges would be eliminated by the installation of a local automatic private branch exchange, since the traffic can be handled automatically to even greater advantage by a much smaller number of trunks available in common to all the stations in the given group. The same remarks are applicable to the number of trunks to the company's central offices now in use, as well as to the number of tie lines now connected to the interdepartmental board.

3. In order to still further relieve traffic congestion in the Main central office it is proposed to provide sufficient capacity of automatic switching equipment in Main to accommodate 500 to 1,000 additional lines for subscribers responsible for the bulk of the incoming and outgoing Government traffic, through Main, direct lines being provided for such subscribers with automatic station apparatus or trunk lines terminating in the private branch exchange boards provided with operators' dials or keyboards

for transmitting the impulses required to establish desired connections.

With this arrangement which, in a sense, may be described as a system within a system, from an automatic subscriber's instrument or a private branch board equipped with a dial, it will be possible to obtain desired connections without the aid of any other operator.

In case such a plan should meet with approval it is suggested that it be carried out by the careful selection of the particular subscribers the Government might desire to have directly connected to its system, this being determined very largely by the volume of incoming and outgoing traffic, due consideration being also given to the importance and urgency of such traffic.

The plan presented for consideration is described, for the purpose of explanation, as a step by step plan, designed so that it will first afford relief where it may be most needed. However, nothing except the rate at which the necessary equipment can be furnished by the manufacturers, the availability of ready space and the size of the available installation force would prevent a larger program from being carried out by working in several of the places at once (e. g., Main and War). In view of the advantages gained thereby it is obvious that these should be kept in mind, since directory, information, and other factors involved in the changes are thereby considerably reduced.

The plan as outlined above has been submitted for consideration to a number of engineers qualified to express themselves and has been recognized as furnishing a most practicable means for providing speedy relief from the traffic congestion at the two points where it is most acute.

A number of conferences have been held with a representative of the Automatic Electric Company, who was asked to submit detailed estimates regarding the original cost, and the cost of installation, the cost of maintenace, and an estimate of the time required to carry such a program to a point where substantial relief would be furnished. Formal estimates will be transmitted to the postmaster general.

4. If it should be found that the congestion in North and Columbia central offices should be likely to become so acute as to require the installation of additional manual switchboards, it appears that the better method of furnishing such relief would be through the establishment of a new automatic central office located to the west of the line joining North and Columbia, which do not appear to be advantageously located. This would provide for taking over a considerable part of the residence service furnished through apartment house private branch exchanges as well as taking care of a considerable fraction of the flat-rate residence subscribers who are now located in the area which would be served from such a new office. Details as to exact location, size of office, number of lines, and stations served would have to be based on suitable engineering studies which it has obviously been impossible for the bureau to undertake.

5. To design a system capable of furnishing telephone service to the whole city of Washington requires also detailed engineering studies, and will therefore not be further discussed at this time.

Long-distance and toll conections.—With regard to the question of the feasibility of connecting an automatic system through toll or long-distance lines to manually operated offices, either Bell or independent, our opinion, based on the publicly expressed judgment of Bell engineers and others in cases before public utilities commissions involving the question of "physical connection," is that no obstacles of any sort which can not be readily overcome present themselves.

Kentucky Governor Signs Merger Bill

Gov. Stanley has signed the bill permitting Kentucky telephone systems to consolidate under the constitutional amendment adopted last November.

Terre Haute, Ind., in Merger

Persistent rumors that the Citizens Independent Telephone Company of Terre Haute, Ind., and the Central Union Telephone Company, the Bell system, were about to be merged, if indeed the deal has not already been consummated, have been in circulation for several days.

According to one story, the deal has actually been closed and all the papers signed, sealed and deposited in strong boxes, whereby the Citizens Company takes over the Bell company.

F. H. Kissling, general manager of the Central Union, when asked regarding the story said:

"If such a deal has been made I know nothing of it. If such a merger were proposed the public would be the last to hear of it until everything was definitely settled, without any possibility of a hitch.

"Personally, I am in favor of consolidating telephone companies, where they are conducted as opponents in one city. Regardless of whether the Central Union or the Citizens company operates the system, I hope Terre Haute will see the day when both companies are operated as one concern. The day has gone by when the public need fear injustice from a telephone monopoly. The public utilities commission is supposed to protect the public and does protect the public. I have lived in cities where only one system of telephones were in use and realize the benefits of the one plant idea."

Hart Farwell, of the Citizens company, said: "I would like to oblige, but I have nothing to say regarding the subject."

Auburn, Ind., Merger

Although the petition of the Central Union Telephone Company to purchase the property of the Home Telephone Company in Auburn, Ind., has been approved by the public service commission, it will take several months to complete the merger of the two exchanges. Manager S. E. Van Fleit of the Central Union Company believes that the company will not unite the two exchanges until additional facilities have been installed and more cable has been strung.

Mr. Van Fleit states that a working connection could be made within a month, but that service would be slow until changes and additional equipment could be installed. He believes that the company will not merge the exchanges until the new equipment is installed.

The Central Union Company will not use the switchboard of the Home company nor the telephones used by the Home company. Much of the cable of the Home company can be used. Mr. Van Fleit states that it will be necessary to put up from 8,000 to 10,000 more feet of cable than now used to make the unified service an efficient one.

Central Indiana Owners Meet

The Central Indiana Telephone Owners' Association opened its annual session at Danville April 16. Judge James L. Clark made the address of welcome. R. E. Dorrell, president of the Hope Telephone Company, responded. A number of addresses on technical subjects were on the program for the afternoon session. An operators' school was held in the new quarters of the Consolidated Telephone Company.

San Antonio Enjoins Rate Raise

A temporary restraining order enjoining the Southwestern Telegraph & Telephone Company from asking or receiving new rates in San Antonio, Texas, and from refusing to give service for failure to pay these rates, was issued by Judge W. S. Anderson of the Thirty-seventh District Court, on application of City Attorney R. J. McMillan.

It is set forth that the Legislature, in the charter granted San Antonio, gave the city power to regulate local telephone rates. Pursuant to that power the city commissioners passed an ordinance whereby not only the telephone but other public service corporations might change the rates now in force.

Instead of accepting this method, the petitioner claims, the company has sent out notices to its patrons demanding that they give immediate notice whether they choose to accept a limited service or will pay a 50 per cent increase for the unlimited service. It is declared that this is an effort to trick the people into signing these cards and that the result will be much confusion. Some of the people will not sign, which might entail a vast number of suits, and that where such signatures are obtained the company will undertake to claim that a change in the individual contracts has been authorized by the patrons.

It is urged that the city is a user of many telephones and that their continued use is necessary for the preservation of peace and order in the city, where an unusual situation exists owing to the war and the vast number of soldiers stationed here. It is pointed out that formerly there were two telephone companies operating in San Antonio but that recently the defendant to this action purchased the other company and that the city, as well as thousands of subscribers, will be greatly injured if it is permitted to arbitrarily increase its rates.

The petition asks that the company be restrained from putting these new rates into effect until, in accordance with the city ordinance, it has asked for a hearing and makes proof that the situation warrants the increase demanded. The city contends no such proof has been made and it is convinced that a full investigation will disclose no such raise as contemplated by the company is warranted by the facts.

To Expedite Dallas Merger

Declaring that all efforts will be used to expedite the actual merger of the Bell and Automatic telephone companies as approved in the vote of the people of Dallas, Texas, President J. C. Casler made the following statement:

"The results of the election on the merger are most gratifying. All will now work earnestly to bring about what the people evidently want—a fair and businesslike unification of the telephone service in Dallas, under city supervision and regulation.

"As soon as legal preliminaries can be arranged and materials obtained to make the physical connection, it will be the effort of all concerned to make the merger complete. Just how long it will take to get material we do not know. The war program of the government has and should have first call upon all the material and factories of the country. This necessarily slows up factories in filling private orders. Of course, it will be done within the time limits fixed in the ordinance."

Civil Service Examination

The United States Civil Service Commission announces for May 14 an open competitive examination for associate statistician, for men only. A vacancy in the Interstate Commerce Commission at a salary ranging from $3,000 to $4,500 a year, depending upon the qualifications of the appointee, and future vacancies requiring similar qualifications, at these or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

The duties of the appointee will be to take charge of such statistical investigations as may be assigned, and to assist the statistician in planning the statistical work of the Bureau of Statistics.

Government Platinum Order

The Council of National Defense has issued the following statement supplementary to its statement of Friday, March 1, 1918, which dealt with the steps that the Government had taken to control the production, refining, distribution and use of crude and refined platinum for the period of the war:

The council wishes to state that in issuing Ordnance Requisition No. 510, commandeering crude or raw platinum now in the hands of importers or refiners of this precious metal, it is to be understood that this commandeering order does not apply to or interfere with the purchase by the consumer of any manufactured articles containing platinum.

This explanation is made so that the public may clearly understand the purpose of this action by the Government.

Major Babcock Is Heard From

Major Garrison Babcock, Second Depot Battalion, Signal Corps, U. S. A., who has recently established new records in speedy training at Fort Leavenworth, is expected to sail with his battalion in the very near future. Recent reports indicate that Maj. Babcock is one of the most popular officers at the camp. He was formerly a consulting engineer with principal offices in Chicago and was president of the American Association of Engineers in 1917.

Major Babcock entered the service with a captain's commission, gaining his promotion very quickly. He has also been active in working for the success of the Third Liberty Loan.

Keystone's Quarterly Report

The statement of the Keystone Telephone Company of Philadelphia for the first quarter of 1918 shows gross income for the period of $404,878, which compares with $384,000 in the same quarter of 1917. Net income amounted to $175,240, against $184,000. Interest charges for the quarter amounted to $85,847. The dividend paid during the first quarter of this year was a special dividend of 2½ per cent, or $1.25, on account of back dividends. On February 1, 1918, back dividends on the preferred stock amounted to $25. No payments have been made on the common since organization.

Bell Takes $5,000,000 Liberty Bonds

The telephone companies comprising the Bell telephone system subscribed for themselves and their employes $5,000,000 of the third Liberty loan 4¼ bonds.

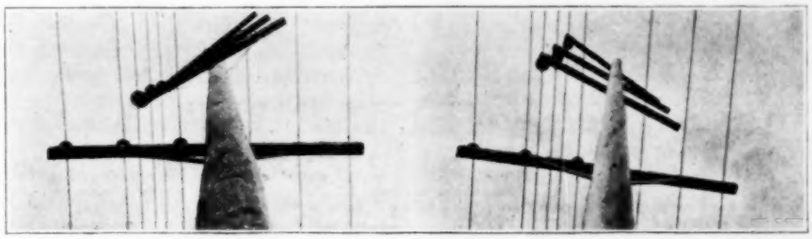
This subscription was apportioned as nearly as may be among the Federal Reserve Districts.

Substitutes for Cedar Poles

Part of the Report of the Engineering Committee for the Pacific Coast Section, N. E. L. A.

BY L. M. KLAUBER

A SUB-COMMITTEE on poles for the N. E. L. A. was appointed on September 8 last, to draft specifications for the purchase of timber for pole use as a substitute for cedar, with particular reference to Douglas fir. Owing to the fact that the other member of the committee was compelled to give up the work, due to the pressure of other business, our investigation has been by no means complete. However, as the writer's company has had some experience with Douglas fir poles during the past year, it is deemed advisable to present such data as have been accumulated.



Twisting of Douglas fir poles—The tendency to spiral as displayed by Douglas fir poles is one of their chief drawbacks.—Journal of Electricity.

Western red cedar poles, which have for years formed the great bulk of the poles used for supply lines in this section, began to be scarce in the early spring of 1917. At first the difficulty appeared to be one of transportation; a considerable quantity of poles was said to be available at Washington and Oregon shipping points, but these could not be obtained, owing to the lack of cars and lumber schooners. Gradually this supply was dissipated, and by fall it was practically impossible to secure cedar poles in Southern California, especially in the larger sizes. A few were brought down as deck loads on Douglas fir rafts, and some rafts arrived with cedar mixed in with the fir. In any case the supply was by no means equal to the demand and substitute poles were used in quantity during the last half year. The shortage first due to transportation difficulties, as noted above, eventually developed into an actual material shortage, concerning which one well-known lumber dealer makes the following statement: "Owing to war conditions, and the action of the government in demanding that all the energies of the loggers be devoted to the production of spruce and Oregon pine for war purposes, it is practically impossible to secure cedar poles. In addition, practically all of the cedar timber lands tributary to transportation have been cut over, and even under normal conditions, cedar poles are constantly becoming harder to get. It is only a matter of time until it will be necessary to turn to a substitute." It is the opinion of lumbermen that the best substitute for cedar available on the coast is Douglas fir (or Oregon pine, as it is usually termed in this section), owing both to its availability and characteristics.

The enormous quantities of Douglas fir available in the Northwest are well known. It is estimated that 25.4 per cent of the entire standing timber supply of the United States is Douglas fir. And since this timber is cut and shipped in great quantities for all structural purposes, it is nearly always available in our commercial centers.

In considering any timber for use as supply line poles, certain characteristics demand first consideration; these are, availability, cost, strength, and durability. Availability has been mentioned; cost is naturally closely related therewith since the timber found in the greatest quantities will usually be the cheapest in first cost, and is in this case. The strength of Douglas fir is well known. Says the U. S. Forest service Bulletin No. 88: "Douglas fir may, perhaps, be considered as the most important of American woods. * * * As a structural timber is is not surpassed, and probably it is most widely used and known in this capacity." Therefore, in considering Douglas fir as a substitute for cedar, durability is the most inportant point, since it is the characteristic in which the former is lacking as compared with the latter.

One of the best posted men on poles in the business makes this statement: "The best substitute that can be had on this coast is Douglas fir, and we believe that while in their green state they would be subject to early rot at the ground line, still, after treating with creosote above the ground line, a Douglas fir pole will give very good satisfaction. We do not claim that it will last as long as cedar, but we are under the impression that if properly prepared and treated, its life would be 90 per cent as great as that of cedar."

We have not at hand any data from other companies which have employed Douglas fir in the past, as to the life which they have experienced, and our own installations are entirely too recent to justify any estimates as to probable life. It is, however, the universal belief of pole producers that to secure a reasonable life, an open tank treatment is essential, and that the brush treatment often used on cedar because of its low cost is practically worthless when applied to Douglas fir. Some authorities claim that a fir pole with an open tank treatment will outlast a cedar pole with a brush treatment.

While an open tank treated pole is higher in first cost than a brush treated pole, because of higher labor cost, fixed charges and greater quantity of preservative absorbed, the cost is by no means excessive, varying from 28 to 40 per cent of the first cost of the untreated pole in the yard.

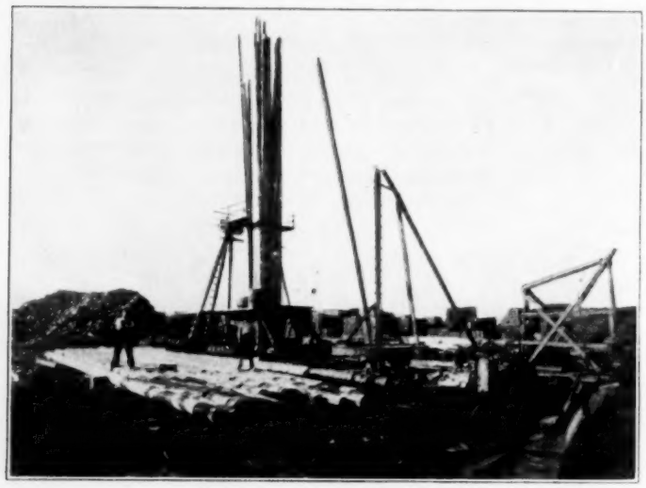
A small treating plant which was used in treating several hundred Douglas fir poles varying in length from 50 to 75 feet is described as follows: There is a cylindrical steel tank 8 feet in diameter and 10 feet 6 inches high, at the bottom of which is placed a steam radiator consisting of 116 feet of 2-inch pipe. Over the steam coil was placed a grid of channel iron upon

which the butts of the poles rest. A steam derrick completes the outfit.

In operation, poles are placed in position and the tank is filled with the specified preservative 6 inches above the depth required by the particular size pole under treatment. Steam is then turned on and the liquid heated to boiling point, or about 220° F. and held at this temperature. The length of time the boiling continues depends entirely upon the character of the poles being treated. Dry poles are usually boiled for one hour; green poles, if necessitated by the exigencies of the construction program, are boiled from two to eight hours to insure thorough impregnation. After the boiling is complete, steam is turned off and the tank is allowed to cool to normal temperature, with the poles still immersed. Cooling in this manner insures the absorption of a maximum of preservative, although it is said that the penetration is not increased.

With reference to penetration, the following statements by the mill man in charge of the plant are of interest.

"Regarding the depth of penetration secured under the treating process, on cedar poles, the liquid usually penetrates to the depth of say wood, running from ½ to ¾ inch, and in some cases 1 inch. Poles that are thoroughly dry produce the most satisfactory results. This is especially true of Douglas fir, as poles of this wood are difficult to treat and secure an even penetration. The poles should be thoroughly dry, but in many that are furnished we do not have time to dry them before treatment. The density of the wood, the quantity of pitch and the case hardening on the outside of the pole during the drying, all affect the depth of penetration in fir. In some instances we have secured a penetration of one inch, and within a foot of this location on the same pole the penetration would be only ¼ inch.



Treating plant for fir poles—There is a cylindrical tank 8 feet in diameter and 10 feet 6 inches high, at the bottom of which is a steam radiator consisting of 116 feet of 2-inch pipe. Over the steam coil is a grid of channel iron upon which the butts of the poles rest. A steam derrick completes the outfit.—Journal of Electricity.

"The sap wood on Douglas fir is as a rule much smaller than cedar and the same penetration cannot be secured as in cedar on this account. It is virtually impossible to treat the heartwood in any species. Our experiences agree with the experiments of the United States government."

Other points which may be mentioned in connection with the use of Douglas fir poles are: Taper, weight, hardness, appearance, checking, and tendency to spiral.

The taper in Douglas fir poles is not so great as in cedar, and consequently modifications are required in the specifications covering this point. The natural taper of a cedar pole is about 1 inch in every 10 running feet, so that the average 45-foot cedar pole having an 8-inch top will have a 12-inch butt. ("Butt" measures are 6 feet from the butt.) But in a Douglas fir pole the taper will only be about 1 inch in 15 feet, so that a 45-foot fir pole with an 8-inch top will have only a 10½-inch butt. As it is undesirable to reduce considerably, size at the ground line, particularly in dealing with a material more subject to decay than cedar, it becomes necessary to modify the specifications for tops as well as for circumference at the butt. It is therefore recommended that the Class A Douglas fir pole have a top not less than 31½ inches in circumference (10 inches in diameter), Class B, 28 inches, and Class C, 25 inches. We then have the following table of minimum dimensions, replacing in the Douglas fir specifications the standard table for Western red cedar. (Handbook of Overhead Line Construction, N. E. L. A., 1914, page 129.)

MINIMUM DIMENSIONS OF POLES IN INCHES

Length of Pole in Feet	Classes A (Minimum Top Circumference 31½ in.) Circumference 6 Ft. from Butt	B (Minimum Top Circumference 28 in.) Circumference 6 Ft. from Butt	C (Minimum Top Circumference 25 in.) Circumference 6 Ft. from Butt
30	37	33	30
35	38	34	31
40	39	35	32
45	40	36	33
50	41	37	34
55	42	38	35
60	43	40	37
65	44	41	38
70	45	42	39
75	46	43	40
80	47	44	41

It will be noted in comparing the above table with the cedar specification that, in spite of the increase in top dimensions the butt diameters are considerably less than cedar poles of corresponding grades, particularly in the larger sizes. This of course cannot be avoided unless top sizes are still further increased for each class of pole which, owing to cost, weight, appearance and other considerations, does not seem advisable. Companies using long poles for particularly heavy work should specify Class A poles having a certain proportion of 11-inch and even 12-inch tops. It may be remarked in passing that the cedar specification appears to be impractical in some details, with reference to the dimensions of poles secured on this Coast, being evidently based on a pole having a greater natural taper than we secure. We have heretofore in purchases been often compelled to modify the specifications, slightly reducing the required butt diameter in long Class A poles. The uses to which the several classes of poles are to be put, and the various proportions of each class to be specified in any order, do not, of course, come within the province of this report.

Air seasoned Douglas fir is said to weigh 34 pounds per cubic foot, air seasoned cedar 33 pounds. The oven dry weights of the two woods are 29 pounds and 25 pounds, respectively. It is evident that Douglas fir poles of similar dimensions will be heavier than cedar, but long poles of similar class, being smaller at the butt, will be lighter than cedar when dried to the same condition.

Douglas fir poles are harder than cedar and more difficult to climb, especially after they have dried and "case hardened." This fact is universally noted by linemen. It is possible that if these poles come into general use, pole steps may again come into favor for certain classes of service.

As Douglas fir poles run straighter and slimmer than cedar, they make even better appearing poles. When trimmed and shaved they are generally dark red in color, whereas cedar is white, and they are consequently more conspicuous until thoroughly weathered. Although prohibited in the specifications, it is believed that poles used in city work, whether of cedar of fir, should be shaved.

Under similar conditions, Douglas fir seems to check less than cedar and the cracks do not run so deep. This difference, however, is not marked and varies greatly in individual cases.

Douglas fir poles, especially when set slightly green, have a decided and unpleasant tendency to spiral. Some rather bad examples are illustrated in the accompanying photographs. Almost every pole has more or less of a twist, as can be plainly seen by the checks, but some appear to untwist much more than others while drying and weathering. As the twist is, however, less than a complete turn in 20 feet, no change need be made in the cedar specification, this being the present limit. (Handbook on Overhead Line Construction, N. E. L. A., 1914, page 131.)

CONCLUSIONS

The standard specifications for the purchase of Western red cedar poles can be used in purchasing Douglas fir, except as to dimensions. The new table of dimensions given above is recommended.

It is not believed that Douglas fir poles will displace cedar as long as the latter are obtainable at a reasonable price. The inferiority of Douglas fir to cedar poles was thus summed up by a lineman: "They rot faster, you can't drive a spur into a dry one with an axe, you can't tell which end is the top, and they twist a line out of shape as they dry." Nevertheless, these difficulties can be overcome. Douglas fir is the best substitute for cedar to be procured on this coast, and the lumbermen predict that the cedar shortage will soon render their use general.

It has been suggested by one prominent lumberman that our association co-operate with the Foresty Department of the Federal Government and the principal pole producers, and study the pole question from the practical side, obtaining data as to the exact available supply of standing timber of the various species suitable for pole use. By co-operation of this nature, we will determine what kinds of poles can be secured and make our specifications accordingly.

Vail Explains A. T. & T. Record

Theodore N. Vail, president of the American Telephone and Telegraph Company, handled critics of the company's financial status with ungloved hands at the company's annual meeting, March 26, remarking that "attempts have been made to discredit our financial position and future prospects by comparisons with last year," and incidentally firing a few hot shots at those who have recently been exerting selling pressure on the company's stock.

"Last year was an abnormal year from every standpoint," continued Mr. Vail. "In the annual report of that year we said that the plant and staff were overburdened; that the surplus plant, which is intended for future growth and emergencies, was brought into use; that as this increased plant carried no additional capital changes, and the gross earnings were abnormal, so were the surplus earnings of the system.

"To get at the real status of our business, comparison should be made with normal years, and these certainly give no reason for apprehension. To fully appreciate the value of your property and its securities, you must take the statements of the Bell system, as these show the operations as a whole. The statements of the American Telephone and Telegraph Company show only the financial operations and the dividends and other receipts from the associated companies and the operation of the long distance lines.

"The Bell system is based on one system—universal, interdependent, with a common control. It is the only way a service such as the Bell is giving can be given. The public have accepted our views and you cannot now find a single locality where the public does not support this policy to its fullest limit, and are forcing us to act when we sometimes are not anxious to. They are not only forcing us to act but are acting for us in arranging consents, orders and approvals of municipal authorities, commissions of regulation and control, and in obtaining the approval of the Department of Justice. We can only say that our public have evinced all appreciation of our attempts to make something for them in the way of a telephone service that is unique to this country and Canada, and makes the standard for the world.

"While we have the usual tribulations, yet we have no more than our share and only enough to keep those who have the burden and responsibility of the service in good healthy condition mentally, only enough to give them experience and teach them to do things better than predecessors, and enough to educate an oncoming staff which may be an improvement upon the old, if that is possible.

"The Bell System has had its period of retardation, but so far never has gone backward, nor is there any indication that it ever will, if the policy of the future is as wise as the present is and the past has been.

"The one system idea brings with it its peculiar difficulties. The public have a dread of aggressiveness and exactions where they are dependent upon one system. This is cared for by commissions of control and regulation looking after the public interest, and in another way by the commitment of the Bell system to limit its dividends and payments on its securities to such an amount as is conceded to be fair and liberal enough to enable it to finance its operations at all times. Charges for service must be sufficient to provide amply for operating expenses, including fair wages, ample maintenance and sufficient depreciation."

At the annual meeting of the company the former directors were reelected and G. D. Milne was elected to fill the vacancy caused by the death of Richard Olney.

$6,000,000 More A. T. & T. Stock

The American Telephone & Telegraph Company has listed on the Boston Exchange $6,000,000 additional capital stock, bringing the total amount of stock outstanding together with the $425,100,000 not yet fully paid, to $442,186,800. This new stock has been issued for the purpose of purchasing from the New York Telephone Company 75,000 shares of the capital stock of the Bell Telephone & Telegraph Company of Pennsylvania.

Loading Coils versus Repeaters

Properly Designed and Correctly Installed, Loading Coils Are Adequate for All Long Distance Work

BY W. N. FURTHMANN

IT has been continuously pointed out in these articles on repeaters, that the principal feature involved in their use requires that intricate, delicate auxiliary apparatus be associated with them in long distance circuits. In Mr. Shreeve's patent . . No. 1,074,298 of September 30, 1913, means are provided for connecting a link circuit to the main circuits. In this patent many of the contentions of the writer as to the numerous, difficult and unsolved problems that may arise in the use of the repeater are admitted by the inventor. The claims of this patent coupled with the admission of these defects or problems involved in the use of a repeater are of value and are summarized as follows:

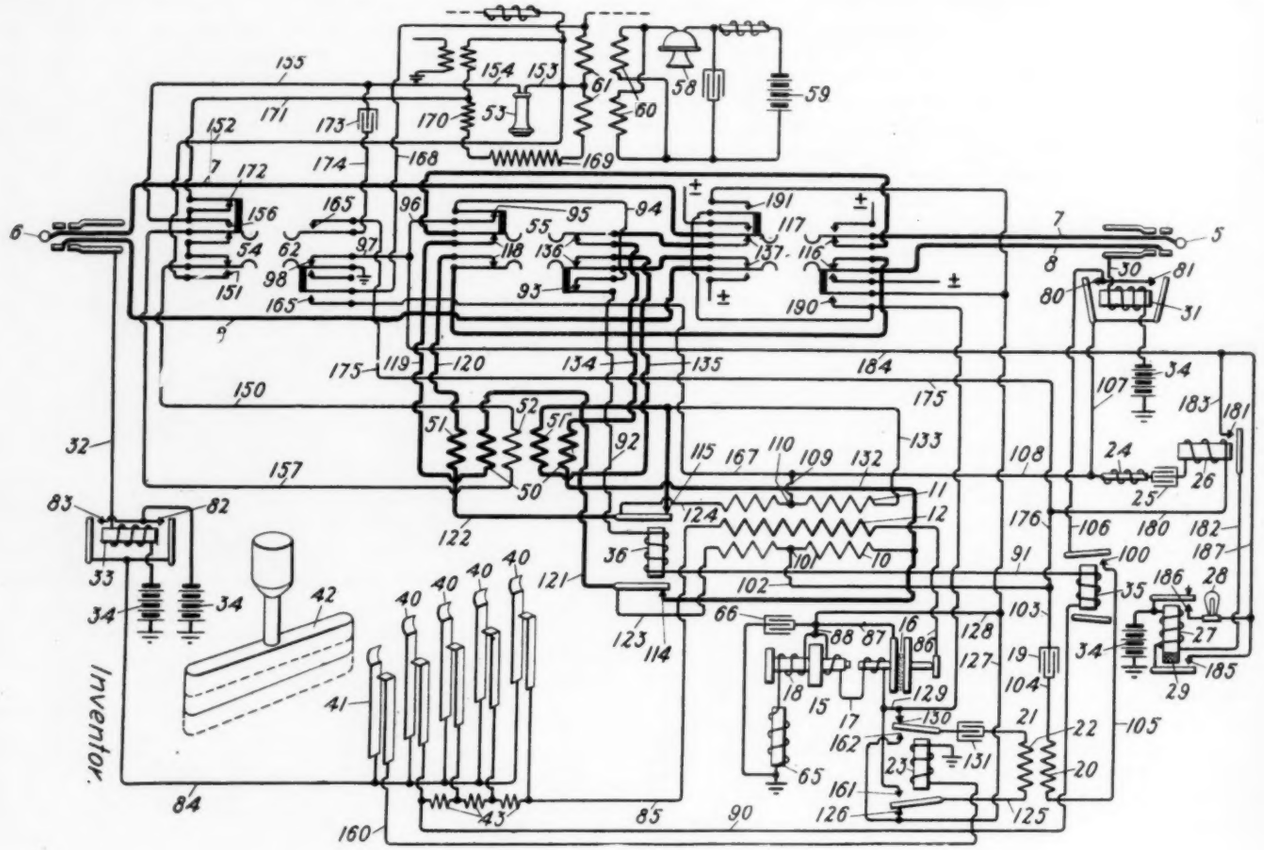


Fig. 1

This invention relates to telephone relay or repeating systems, and more particularly to a system in which the repeating apparatus, including its local repeating circuit, is associated with the two ends of a link circuit in such manner that when the link circuit is connected with the main circuit it constitutes a connection between the two main circuits uniting them into a single compound circuit for through communication.

One of the objects of this invention is to provide means for connecting a telephone receiver to the repeater circuit in such a manner that it will provide an adequate volume of receiving for supervisory purposes and will not appreciably shunt transmission and will not unbalance the repeater circuit. This is accomplished by providing a supervisory coil having one receiver winding in inductive relation to a plurality of line windings connected on both sides of the circuit so that any differences in phase of the current variation on opposite sides of the repeater will be readily indicated and reactive line disturbances will be obviated.

Another object of this invention is to provide an efficient means for regulating or adjusting the repeater to operate on particular line combinations and to compensate for certain variables such as a fluctuating battery voltage due to charge and discharge and high resistance of the transmitter element in the repeater itself due to continuous use. This is accomplished by changing the phase relation of the input and output current of the repeater, to the conditions of unbalance met with and regulating the output of the transmitting element to the same conditions. The means for accomplishing this consists in placing a variable resistance in series with the magnetizing, winding and transmitting element of the repeater. The amount of resistance in series with the battery magnetizing winding and transmitting element regulates the output of the repeater to any desired degree. The resistance is varied by means of a slide key which also controls the circuit through a relay to reverse the poles of the receiver for changing the phase relations of the input and output currents to the conditions of unbalance of the line.

Another feature of this invention relates to the means provided for preventing the humming of the repeater in case one end of the link is accidentally disconnected from the line. This feature consists in providing a relay in the third wire circuit or sleeve strand of the connectors, one of these relays being adapted when operated to put battery on the repeater, the other being adapted to close the secondary coil which supplies current to the receiving element.

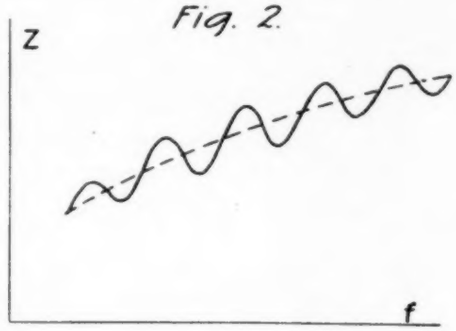
Another feature of this invention relates to the connection

of the supervisory relay whereby the balance of the system is maintained. This consists in bridging the supervisory relay at the center of the system in shunt of the repeater bridge. This accomplishes two things:—First, it renders the system balanced and it provides a system in which the supervisory relay is equally sensitive to ringing currents from each side,

The drawing is a circuit diagram of the apparatus illustrating all of the features of this invention in connection with a cord circuit.

Referring to the drawing, Fig. 1, *5* and *6* designate three conductor plugs located one at each end of the repeater cord circuit and adapted for insertion into jackets (not shown) of the long

Fig. 2.



distance lines terminating in the same office as the repeater cord circuit. Connected in the tip and ring conductors *7* and *8* of the plugs *5* and *6*, are secondary windings *10* and *11* of a repeating induction coil, the primary *12* of which is connected with a source of current and the transmitter element of a repeater *15*. The repeater *15* is preferably of the type shown and described in U. S. Letters Patent No. 836,612 issued to me November 20, 1906, or my co-pending application Serial No. 629,261, filed May 25, 1911; and comprises a transmitter element *16*, a receiver or operating winding *17* and a magnetizing winding *18*. Connected with the middle point of the windings *10*, and in series with a condenser *19* is a primary winding *20* of an induction coil *21*, the secondary *22* of which is adapted for connection with the operating winding *17* of the repeater through contacts on a relay *23*. Also connected with the middle point of the winding *11* in shunt with the repeater bridge and in series with a retardation coil *24*, and a condenser *25*, is a supervisory relay *26*, the contact of which controls a slow-acting relay *27* which, when operated, locks up and completes a circuit for a supervisory lamp *28*. The relay *27* is made sluggish in its operation by means of a copper sleeve or collar *29* for the purpose of preventing this relay operating upon discontinuous or momentary impulses of current such as result from the operation of telegraph apparatus connected with the line.

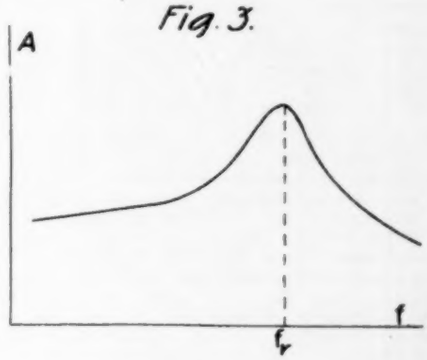
Connected in the sleeve strand *30* of the plug *5* is a relay *31* which is operated when the plug *5* is inserted into the jack of the desired line, and, when operated, closes contacts in the repeater bridge. In the sleeve strand *32* of the plug *6* is a relay *33* operated upon the insertion of the plug *6* into its jack. The relay *33* is adapted when operated to connect battery *34* with the transmitter element *16* of the repeater *15*; also with relays *35* and *36*, the relay *35* being adapted when operated to complete the repeater bridge, and the relay *36* being adapted to open a short circuit of the windings *10* and *11* normally maintained through the back contacts of said relay. In circuit with the battery *34* is a special switching key such as shown and described in my allowed application Serial No. 654,279, filed October 12, 1911. This key comprises in general four sets of contact springs *40*, *40* of the same length, and one set of springs *41* shorter than the springs *40*, *40*, together with a longitudinally-movable reciprocating plunger *42*, adapted in one position to be moved into engagement with the longer contact springs only, and in its other position to engage all of the contact springs. The operation of the longer contact springs *40*, *40* completes a circuit from the battery *34* through resistance *43*, *43* and the operation of the springs *41* completes a circuit for the pole changing relay *23*.

Connected in the tip and ring conductors of the cord on each side of the windings *10* and *11* are primary windings *50*, *50* and *51*, *51* of a repeating coil, the secondary *52* of which is adapted to be connected with the operator's receiver *53* through a key *54*. With this arrangement of windings on both sides of the repeater, any differences in phase in the currents on opposite sides of the repeater will be readily detected in the blurred receiving which results. One pair of the windings *50*, *51* is connected with one side of a cut-off key *55*, the other pair of said windings being connected with the other side of said key, the operation of this key enabling the operator to talk on to the line in either direction without interference from the third party.

The telephone receiver *53* forms part of an operator's telephone set, comprising in addition a transmitter *58*, local battery *59*, and primary *60* of an induction coil, the secondary *61* of which comprises two windings, one of which is adapted to be connected in series with the receiver, and in bridge of the tip and ring conductors of the cord by means of a "talk and listen" key *62*. The magnetizing winding *18* of the repeater is connected to ground. The other of these paths is from battery *34*, conwinding *18* are shunted by a condenser *66*; the function of the retardation coil *65* is to limit the flow of current through the winding *18*, and that of the condenser *66* to localize the microphone currents in the transmitter button and primary winding and to exclude such currents from the magnetizing winding *18*.

Referring now to the operation of the apparatus and circuits, it will be assumed that the plugs *5* and *6* are inserted into the jacks (not shown) of the lines which are to talk through the repeater; with these plugs inserted, ground will be connected with the sleeve contacts thereof and circuits completed for the sleeve relays *31* and *33*. The operation of the relay *31* closes its front contacts *80* and *81*, and the operation of the relay *33* closes its contacts *82* and *83*. The closing of these contacts is preliminary to the succeeding operation which is the movement of the key slide *42* into position to close the first pair of contacts *40*. The closure of this pair of contacts completes two paths for current, one of which may be traced from the battery *34* through the contacts *82* and *83* of relay *33*, conductor *84*, contacts *40*, resistance coils *43*, *43*, conductor *85*, winding *12* of the induction coil of the repeater, conductor *86* to one electrode of the transmitter *16* of the repeater, through the comminuted material to the other electrode thereof, conductor *87*, conductor *88*, magnetizing winding *18* of the repeater and retardation coil *65* to ground. The other of these paths is from battery *34*, contacts *82* and *83* of relay *33*, conductor *84*, contacts *40*, conductor *90* winding of relay *35*, conductor *91* winding of relay *36*, conductor *92*, contact *93* of cut off key *55*, conductor *94*, contact *95* of cut off key *55*, conductors *96* and *97*, and contact *98* of "talk and listen" key *62* to ground. The first of these paths traced completes a circuit for the transmitter of the repeater while the second completes an energizing circuit for the relays *35* and *36*. The operation of relay *35* closes its contact *100* and completes a bridge of the cord conductors including the winding of *20* of the coil *21*. This circuit may be traced from the middle point *101* of the winding *10*, conductors *102* and *103*, condenser *19*, conductor, *104*, winding *20*, conductor *105*, contact *100* of relay *35*, conductor *106*, contacts *80* and *81* of relay *31*, conductor *107*, conductor *108* and conductor *109* to the middle point *110* of winding *11*. This constitutes the input circuit of the repeater and as will be noted, can only be completed when the plugs are in their jacks, thus preventing the repeater from humming in case one of the plugs is accidentally pulled down. This feature

Fig. 3.



is further guarded against by having the coils *10* and *11* normally short-circuited through normally-closed contacts *114* and *115* of the relay *36*, which are opened when this relay operates.

In the operation of the repeater, voice currents coming over the line to the end of the plug *5* will find a path over the conductors *7* and *8*, through normally closed contacts *116* of a ringing key *117*, normally closed contacts *118* of the cutoff key *55*, conductors *119*, *120* through one set of windings *50*, *51*, conductors *121* and *122*, conductors *123* and *124*, the two left-hand halves of the windings *10* and *11*, and the bridge of the coil *20*

previously traced. This will induce currents in the winding *22* of the coil *21*, which induced currents will cause the movable polepiece of the repeater to vibrate. The vibrations of the movable polepiece and its attached electrode being made more forceful by the initial magnetization produced by current in winding *18*. Assuming that the pole changing relay *23* is in the position shown, the circuits for the induced currents will be from one side of the winding *22* over conductor *125*, contact *126* of relay *23*, conductor *127*, conductor *128*, conductor *88*, winding *17*, conductor *129*, contact *130* of relay *23* and condenser *131* to the other side of the winding *22*. The reciprocation of the plunger caused by the current in this last traced circuit will cause an agitation of the comminuted material between the electrodes of the transmitter *16* and a consequent variation in the resistance of the circuit and the battery current through the winding *12* which will in turn induce a current in the other halves of the windings *10* and *11*, conductors *132* and *133*, the other set of windings *50* and *51*, conductors *134* and *135* normally closed contacts *136* of cutoff key *55*, normally closed contacts *137* of ringing key *117* to conductors *7* and *8*, and to the line with which plug *6* is connected. The circuit under consideration being a two-way repeater circuit, it is clear that in talking from the end of the plug *6* the paths for the incoming and outgoing voice currents would just be the reverse of those traced.

Referring now more specifically to the supervisory features of the system, it will be noted that when key *54* is operated, it connects the receiver *53* and winding *52* in series, the circuit being as follows: from one side of winding *52*, conductor *150*, contact *151* of key *54*, conductor *152*, conductor *153*, receiver *53*,

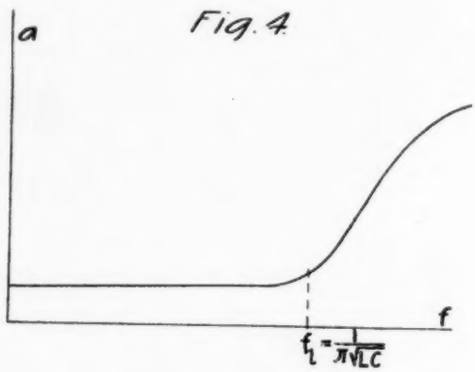


Fig. 4

conductor *154*, conductor *155*, contact *156* of key *54*, and conductor *157* to the other side of the winding *52*. This places the receiver *53* in condition to receive induced currents from the windings, *50*, *50* and *51*, *51* and any difference in phase of the currents on opposite sides of the repeater due to difference in the impedance upon the two sides of the repeater bridge will be indicated by blurred receiving, which results with the receiver in inductive relation to the line upon both sides of the repeater bridge, the true condition of the circuit upon both sides of the repeater bridge will be indicated to the operator and the three requirements previously set forth will be met.

The control of the repeater to compensate for certain variables met with such as fluctuating battery voltage due to charge and discharge, and high resistance transmitter elements of the repeater due to continued use may be governed by regulating the output of the repeater and changing the phase relation of the input and output currents of the repeater to compensate for unbalanced conditions of the line. This may be accomplished in various ways, such for instance as reversing the terminals of the primary winding *12* in the output circuit, reversing the terminals of the input winding *20* or reversing the terminals of the operating winding *17* of the repeater. This last is the preferable method and the one shown on the drawing. To explain more fully, it is to be noted that the repeater is a polarized instrument and the direction of movement of the transmitter plunger will therefore be dependent upon the polarity of the repeater operating current. There is naturally a slight lag in the transmitter element, due to the inertia of the parts, and it may well happen, and frequently does in practice, that due to the polarity of the operating current and the inertia of the movable parts, the repeater current is approximately 90 % behind the operating current, under which condition a condition of unbalance between the line and the repeater circuit results, and the currents in these two divisions will cancel each other. The reversal of the polarity of the repeater will change the phase relation of the repeater current to co-act with that of the operating current so that instead of opposing or canceling, these currents will be in a proper phase with respect to each other to produce the best conditions for talking.

Referring first to the means for regulating the output of the receiver, it will be noted that the advance of the slide member *24* into the engagement with the last three of the sets of springs *40*, *40* short circuits the resistance elements *43*, *43* in series with the battery *34* and the transmitter element *16* and magnetizing coil *81* of the repeater *15*, thus increasing the current and regulating the output of the repeater. The other feature of the adjustment, namely that of changing the phase relation of the output and input currents of the repeater to the unbalanced condition of the line, is accomplished by the actuation of the set of contacts *41* by depressing the slide member into the position indicated in dotted lines on the drawing and moving it into engagement with the said contacts. The closure of the contacts *41* completes a path for current which may be traced as follows: from battery *34*, contacts *82* and *83* of relay *33*, conductor *84*, contact *41*, conductor *160*, and a winding of relay *23* to ground. Current in this path operates the relay *23* opening its back contacts *126* and *130* and closing its front contacts *161* and *162* thus reversing the poling of the operating winding *17*. The slide key is so arranged that the plunger member *42* cannot be depressed in any except its normal position, or when it is entirely free from engagement with the contact springs, thus making it impossible to change the poling of the receiving element with the full battery current through the output circuit.

When the "talk and listen" key *62* is operated, it breaks ground contact and closes contacts *165*, *165* and connects the secondary *61* of the induction coil across the line at the middle points of the windings *10* and *11* with the receiver in series with one of the windings and in parallel with the other. The bridge will be as follows: from the middle point *110* of winding *11*, conducor *109*, conductor *167*, contact *165* of key *62*, conductor *168*, secondary winding *61*, windings *169* and *170*, conductor *171*, normally closed contact *172* of monitoring key *54*, conductor *155*, condenser *173*, conductor *174*, the other contact *165* of key *62*, conductor *175*, conductor *176* and conductor *102* to the middle point *101* of winding *10*. The receiver *53* is connected with the middle point of the winding *61* and one side of the condenser *173*. The breaking of the ground contact opens the circuit for relays *35* and *36*, thus rendering the repeater inoperative.

In the operation of the supervising relay *26*, ringing current coming from either end of the line, will come in over one side of the line to the middle point 101 of winding *10*, through conductor *102*, conductor *176*, conductor *180*, winding of relay *26*, condenser *25*, retardation coil *24*, conductor *108*, conductor *109* to the middle point of *110* of winding *11* and back over the other side of the line. Current in this path will energize relay *26*, causing it to operate and close its contact *181*, thus completing a circuit for the relay *27*, which may be traced from battery *34* through the winding of the relay *27*, conductor *182*, contact *181* of relay *26*, conductor *183*, conductor *184*, conductor *97* and contact *98* of the "talk and listen" key to ground. Current in this circuit operates the relay *27* to close its contacts *185* and *186*, which closes a circuit for the relay winding and supervisory lamp which is the same as that just traced, except that conductor *187* is substituted for the path through the contact *181* of relay *26*. Current in this last-named circuit retains the relay *27* in its operated position, and the supervisory lamp *28* lighted until the talk and listen key *62* is operated. The combined impedance of the retardation coil *24*, condenser *25* and relay *26* is such that the circuit including them will afford a ready path for the ringing currents, but will not appreciably shunt the talking currents. The operation of the ringing key *117* short circuits the operating coil *17* of the repeater, this short circuit being established through contact *190* in one position of the ringing key, and through contact *191* in the other position of said key.

Some inventors of repeaters in their various patents advance the broad claim that the gain obtained by their particular design of repeater is not limited. In other words, provided sufficient current is properly applied to a given circuit the extent of space over which that circuit will give talking service is unlimited. Since these broad claims are advanced with the contention that the use of loading coils is necessarily limited, it is essential to show that such claims are not substantiated by actual practice nor by mathematical formulas. In this connection it will be of interest to note that evidence will be produced in which the admission is made that the stability of a

repeater depends upon practical loaded line conditions. In other words it will be shown that the inventors of repeaters agree that line conditions maintained by the use of loading coils determine the efficiency of a repeater of even the most improved type.

It can be stated therefore as a matter of theory as well as a matter of practice, that if each balancing network is not exactly equivalent at all frequencies to its corresponding line a condition will be set up in which one repeater in the circuit will feed power back into another repeater resulting in a local circulation of power in the repeater station. When this unbalancing of lines and network becomes sufficiently large the power circulation becomes cumulative, giving rise to an unstable operation which causes singing or howling of the repeater and of course thus destroys the usefulness of the repeater. Actual practice has confirmed theory in this respect. It is absolutely known that the relation between the amplifying power of the repeaters and the allowable unbalance between the artificial balancing lines and actual lines is a reciprocal one.

So that if U_1 and U_2 are the impedance unbalances of the two lines and their networks and if A_1 and A_2 are the amplifying powers of the two repeaters these quantities are related by the equation

$$A_1 A_2 \text{ a } \frac{1}{\sqrt{U_1 U_2}}$$

Thus the maximum amplifying power of a repeater is limited by the closeness with which the lines and networks may be balanced and in practice this is what limits the gain which may be made with any kind of a repeater. There are cases as a matter of fact where line conditions are such that an accurate balance can not be obtained and singing and howling of the repeater of course are the result. In such instances the non-singing conditions of the repeater can only be obtained by impairing materially the amplifying power of the repeater system.

In practice it has been found that the impedance of a loaded line changes with frequency in the manner shown by the full line curve of Fig. 2, which represents the relation between the frequency F and the line impedance Z. In practice it has been found impossible to exactly simulate this impedance by means of a balancing network although its average trend as shown by the dotted line may be imitated in the balancing network or artificial line. Since an imitated condition is necessary and only an imitation condition used for balancing, it will be always clear that there is therefore a certain amount of unbalance at same frequencies even under the most ideal conditions in the most carefully constructed lines. This causes a most serious limitation on the amplifying power of a repeater which may be used, particularly with a repeater which has unequal amplifications at different frequencies. For in this case the amplification must be made so small that at the frequency of the most efficient operation of the repeater the conditions pointed out in the above formula must not be violated.

The curve of Fig. 3 shows the relation between the frequency F and the amplifying power A of a repeater of the receiver-microphone type. It will be noted from this curve that the point of the most efficient amplification lies at a certain definite frequency F_R which is the frequency of resonant response of the vibrating system. It has been also found in practice that in any loaded line having lumped inductance L and distributed capacity C the attenuation offered to the currents in the line is related to the frequency of these currents by a relation which is shown graphically in Fig. 4. It will be seen at once that the attenuation has a small value for a considerable range of frequencies and that it rises abruptly at a certain value of frequency which may be shown theoretically to be equal to

$$\frac{1}{\pi \sqrt{L C}}$$

In this formula L and C are respectively the inductance and capacity per loading section of the loaded line. A comparison of the curves of Figs. 3 and 4 which represent respectively characteristics of the repeater and of the line will show that if the resonant frequency F_R is made to fall below the frequency F_L at which the line begins to offer a high attenuation the average amplification allowable in the repeater will be small since the peak of the curve of Fig. 3 must be low enough to insure that no singing or howling occurs at that amplification. The amplification over the rest of the range will therefore be restricted to a much smaller value. Provided the resonant frequency of the repeater can be made to fall outside the range of free transmission of the loaded line and maintained at that condition, that is if F_R is made considerably greater than $\frac{1}{\pi \sqrt{L C}}$ any tendency to sing at the frequency F_R is resisted by a greatly increased value of attenuation in the loaded line and the determined average amplification allowable over the range of free transmission of a loaded line is much increased. The amplification at various frequencies inside the range of transmission of a loaded line would be made more uniform because the curve of Fig. 3 is approximately straight except in the neighborhood of the resonant frequency of the repeater. In operating such a resonantly responsive repeater on a loaded line it would be essential for high efficiency that the resonant frequency be considerably higher than the frequency at which the line begins to offer an increasing attenuation. Where this so-called cut-off frequency is in the neighborhood of 2200 periods per second, as in the case of the average loaded line, a repeater having a receiver-microphone system may be found capable of producing the desired result.

In these articles considerable mention has been made of the necessity of using what has been termed an artificial line. It is generally known that the impedance of a transmission line can be simulated to any desired degree of precision by constructing an artificial line consisting of a series of sections, each section containing an inductance element and a resistance element in series with the line and a condenser in shunt across the line.

Such an artificial line is a model of the actual line, differing from the actual line only in that the electrical constants of the actual line are uniformly distributed while those of the artificial line are concentrated or lumped. Before proceeding with a discussion of repeater circuits containing artificial lines it may be of value as a matter of clearness to explain the principles upon which an artificial line is based.

A well known general formula for the impedance of a long uniform line is

$$K = \sqrt{\frac{R + 1 P L}{G + 1 P C}}$$

where K denotes the impedance
R L G and C the distributed resistance inductance, leakage conductance and capacity per unit length of line

$$i = \sqrt{-1} \quad \text{and} \quad p = 2 \pi F$$

in which F denotes the frequency in cycles per second.

In practice the leakage conductance G is so small that it may be disregarded so far as its effect on the impedance is concerned, and a close approximation of the foregoing formula is

$$K = \sqrt{\frac{C}{L}} \sqrt{1 - 1 \frac{R}{PL}}$$

In the case of ordinary aerial lines the resistance R is quite small compared with $P L$ over the range of telephonic frequencies so that a further approximation is

$$K = \sqrt{\frac{L}{C}} - 1 \frac{R}{2P} \left(\frac{1}{\sqrt{LC}} \right)$$

The value of K as expressed by the last equation is precisely the impedance of a resistance R_0 in series with a capacity C_0 of

$$R_0 = \sqrt{\frac{L}{C}}$$

$$C_0 = \frac{2\sqrt{LC}}{R}$$

It therefore follows that the impedance of R_0 in series with C_0 when R_0 and C_0 are determined by these equations is very closely equal to the impedance of the uniform transmission line. These equations are then the design formula for determining the values of the two elements.

The design formula for determining the elements of long periodically loaded transmission lines depends on the position of the initial end with regard to the first loading point and the frequency of the current transmitted. This impedance may of course be simulated as closely as desired by constructing an artificial model of a given loaded line, section by section. This procedure is expensive and because of the large number and wide range of the variables involved an experimental attempt at proportioning a simple network to fulfill the severe requirements is impracticable.

(To Be Continued.)

Chicago Proceeds Against A. T. & T.

Judge Walker in the Circuit court at Chicago has granted Corporation Counsel Samuel A. Ettelson, through the state's attorney's office, permission to file information in the nature of quo warranto against the American Telephone and Telegraph Company, calling upon it to show by what warrant or authority it uses the streets of the city of Chicago to carry on its telephone business.

According to the information, a state law expressly provides that no telephone company possesses the right to construct lines, erect poles or wires in the streets of any city without obtaining the consent of the municipal authorities.

The bill of information states that the American Telephone and Telegraph Company now owns telephone lines in Archer avenue, west of Cicero avenue, and that it is using upward of a million dollars' worth of property in the city without the consent of the city council.

According to Assistant Corporation Counsel Ralph G. Crandall, the company has direct contracts with brokers and other firms for leased wires, and the money is paid directly to the company. He said that the Chicago Telephone Company derives a monthly rental of $5 from the American Telephone and Telegraph Company for each subscriber. The rentals paid by the brokers for New York leased wires are $16,000 annually—to Milwaukee, $3,500; to St. Louis, $5,000, and to Minneapolis, $8,000 the bill of information sets forth.

According to Corporation Counsel Ettelson, the American Telephone and Telegraph Company can bring its lines only to the city limits. The company holds, according to Mr. Ettelson, that the Chicago Telephone Company is doing the business in Chicago. The latter company paid $598,960 to the city in 1917 for the privilege of operating its lines in the city, Mr. Crandall said. In addition it gives certain service to the city free.

Up to 1911 the company openly owned and constructed its lines in the city, the bill declared. It maintained two exchanges, the long distance exchange at 111 North Franklin street and the Morrell Park operating station.

In 1911 it entered into a contract with the Chicago Telephone Company, turning over most of its property, the bill of information says. Then in 1913, as the result of protests by the city, it turned over its two exchanges.

The American Telephone and Telegraph Company pays the Chicago Telephone Company $18,000 a month for the use of certain property in Chicago, but it does not pay the city a cent for the use of the streets, the bill of information recites.

Should the court hold against the company and decide that it is illegally using the lines in Chicago the city council would then arrange an ordinance with the American Telephone and Telegraph Company, Mr. Ettelson said, stating the terms on which the company is allowed the use of the streets.

Detroit-Windsor Toll Raised

Reciprocity in love between Detroit, Mich., and Windsor, Canada, young people has grown to such an extent—via the telephone—that the Bell Telephone Company of Canada decided to increase the Windsor-Detroit toll. The new rate is 5 cents for the first three minutes and 5 cents for every subsequent three minutes.

"Dan Cupid" has obtained such a hold on young people of the neighboring international cities, Manager F. W. Dewar said, that it has become almost impossible to handle business calls, especially after 6 o'clock in the evening.

"These 'lovey-dovey' couples hold onto the lines for hours," said Manager Dewar. "Since the passport regulations went in effect, Windsor young men of military age find it difficult to fulfill engagements with lady friends in Detroit, and they now use the telephone. And some of the old folks are just as bad."

Believing the company is using "Dan Cupid" to camouflage a carefully-laid plan to compel business men of the border cities to pay more for their Detroit calls, city aldermen brought the question before the city council.

Although Alderman F. H. Howell, chairman of the finance committee, considers the increase "fair and reasonable," Alderman E. B. Winter and several others termed the increase "unfair."

Until about five years ago there was no charge for Windsor-Detroit calls, but the 5-cent charge was imposed because subscribers "visited" over the telephone.

New cables under the Detroit river are planned, Manager Dewar said, to care for the increased business, and consent of the United States and Canadian governments has been obtained for the work, but materials are not available.

Unusual Business—*Not* Business As Usual

Prepared by the War Committee of The Union League Club of Chicago

BY HAROLD G. MOULTON

Harold G. Moulton, who has a national reputation as an economist, is a member of the Department of Political Economy of the University of Chicago; Acting Editor of the *Journal of Political Economy;* Secretary of the Western Economic Society; Author of *Waterways versus Railways, Principles of Money and Banking,* etc.

HOW may American industries most effectively aid in the successful prosecution of the war? What readjustments, if any, must be made in the coming months to insure the production of the perfectly stupendous quantities of supplies and materials that war imperatively demands? Can we secure these supplies by speeding up production in existing factories and workshops, or must we transform in considerable measure the character of our industries, eliminating the nonessential and thereby diverting productive energy more largely into war channels?

In the present paper an attempt will be made to throw light upon these vital questions. First, we shall make a simple analysis of the industrial requirements of the war; secondly, a statement of the lessons that are to be learned from the experience of Europe during the past three years; thirdly, a brief statement of the lessons from our own experience to date; and finally we shall give an account of the plans for the future that are now being formulated at Washington.

THE FUNDAMENTAL REQUIREMENTS OF THE SITUATION

Someone has said—I think it was Napoleon—that three things are necessary to wage a war successfully: Money, more money, and still more money. There is a great deal of truth in this statement in ordinary wars, but as applied to the United States in the present conflict is entirely misleading. Money is of paramount importance when a nation may buy its war supplies from abroad. England and France, for instance, before our entrance into the war, purchased with money vast quantities of war supplies from the United States. But it is impossible for us to use money, to any great extent, in buying goods from other nations, for the simple reason that the entire commercial world is now at war. With his money Uncle Sam can buy war supplies only from himself. There are of course a few exceptions to this, such as nitrates and rubber; but, substantially speaking, Uncle Sam must produce all the things which he is to use in the war. We the people turn funds into the Treasury and then Mr. McAdoo buys from us the supplies needed. The amount that he can buy is determined, in practice, by the amount of war supplies we have produced. Similarly, when we extend *credit* to our allies we really say to them, We will furnish you with materials and supplies now and you may pay for them after the war is over. This point must be strongly emphasized; for many people fancy that furnishing credit to our allies means merely sending them money, or perhaps some sort of draft or credit instrument. In the last analysis it always means that we send them goods, which they are to pay for at some future time.

To understand, then, the real problem with which we are confronted, we must think in terms of goods rather than in terms of money. Three things, in the main, are required of us, aside from soldiers:

1. Ships—as many as can be constructed.
2. Supplies and munitions—as many as can be furnished.
3. Food—as much as can be produced.

While these are the specific *things* that are required, it is obvious that to produce these things in utterly unprecedented quantities will require the development first of many industries that are auxiliary to ship building, war manufacture, and farming. The modern industrial world is extraordinarily complex, and every fundamental industry has a multitude of handmaidens.

Now let us see precisely what this involves in the way of industrial mobilization. We have in the United States, let us say, 60,000,000 working people. Ordinarily these 60,000,000 workers produce (1) essentials, (2) nonessentials. In time of war many of these workers are drawn off from productive industry to war service, but enough others are pressed into the industrial ranks to take up much of the slack—possibly they fully replace the number who are called to the colors. Let us assume that we have 60,000,000 workers who must produce the indefinite quantities of ships, supplies, munitions, and food that are demanded.

Now there are just two possible alternatives before us: First, these 60,000,000 workers must be speeded up to a point where they will be producing not only the usual quantities of (1) essentials and (2) nonessentials, but in addition the unlimited quantities of ships, supplies, munitions, and food that are required; or, secondly, we must produce (1) essentials; but then, instead of producing (2) nonessentials, transfer, so far as may be practicable, the factory power and the labor power ordinarily devoted to producing luxuries to the production of the indispensable ships, munitions, and other war materials.

When the war began it was generally assumed in the United States that the first of these alternatives would be adequate to meet the requirements of the situation. We assumed that the production of war supplies could be undertaken as an extra—that we could speed up our factories and our workers sufficiently to meet all war demands. We did not understand how utterly insatiable are the demands of modern warfare. The notion that war production can be carried as an extra is, however, no longer held in government circles. It is now conceded that we must resort to the second method. In order to understand clearly the reasons for this change we must consider the lessons that the United States has learned from Europe in this connection.

WHAT GERMANY HAS DONE

One of the best ways of ascertaining the problem that lies before us is to study the German method of industrial mobilization. We have all wondered many

times how Germany has been able to finance the war, how she has been able for four years—though largely cut off from the outside world—to resist the economic pressure of the Allies and at the same time procure the necessary war supplies for campaign after campaign—yes, let it be faced squarely—for victory after victory against her united enemies.

There is just one answer to this question. As soon as it became apparent that the war would be long-continued Germany set about the eliminating of all nonessential industries; factories which had been producing luxuries were converted into munitions or supplies plants, where possible; and where this was not possible they were closed down and the laborers transferred for war service in essential industries. Germany thus early got right down to brass tacks. Indeed, in some instances Germany did not even wait to discover whether the drive on Paris would be successful. Secretary Baker tells us that he knows of one case where within twenty-four hours after the outbreak of the war one-half of the laborers in a large nonessential industry were placed in the army and the remainder transferred to war industries. A selective draft for industry appears to have been a part of Germany's war preparedness.

Germany recognized, in other words, that for every soldier at the front there must be several (industrial) soldiers at the rear; and the principles of military organization were made to apply to every aspect of national life. A certain percentage of the national energy was put on the battle fronts; a certain percentage was devoted to the creation of submarines; a certain percentage to the manufacture of supplies and munitions; and a certain percentage to the production of foodstuffs. All useless effort, all waste motion, as far as possible, was thus eliminated—everything was arranged with an eye single to military victory.

THE EXPERIENCE OF FRANCE

It was quickly realized in France that "business as usual" would be nothing short of national suicide. Three-quarters of the male laboring population between the ages of eighteen and forty-five were called to arms literally overnight, with the result that French industry during those first awful weeks was largely paralyzed. France was relying upon her accumulated stores of supplies, plus importations from England and America. But after the pressure on the west was somewhat relieved and after it became clear that a long struggle was inevitable, France recalled from the trenches skilled laborers and mechanics who could henceforth serve the nation more efficiently in the industrial army. But when these men were withdrawn from the front it goes without saying that they were not delegated to produce luxuries and nonessentials; they were set to upbuilding war industries to the end that the armies might be certain of obtaining a steady replenishment of the indispensable weapons and materials of warfare. There cannot be the slightest doubt that France would have been crushed during those endless months of waiting for England to get ready if she had not been making her national energy count effectively in the struggle in which she was engaged.

It is necessary to state, however, that France has not gone as far as Germany in the elimination of nonessentials. It appears that some luxuries have continued to be manufactured and sold in France, at least until very recently. Need we add that every ounce of national power thus misdirected is an ounce of power lost in the struggle against Germany?

THE LESSONS FROM ENGLAND

England, across the channel, and hence free from invasion, long deluded herself with the notion that she could have business as usual and at the same time cope successfully with an enemy that was wonderfully efficient in its organization for war. But England eventually awoke—in about two years—to the real requirements of the grim business of war. I quote from Hon. R. H. Brand, vice-chairman of the British War Mission to the United States: "We discovered to our surprise at the beginning of the war, that war apparently meant prosperity and not poverty. Wages advanced and millions found that they had more money than they had ever had before. The result was that consumption actually tended to go up among the poorer classes, and labor and materials vitally required for war purposes were *diverted* to meeting these new demands. But we found that 'business as usual' is impossible. The ravenous demands of a modern war compel every nation at war to choose between peace and war; if they have elected for war, they must order their economic lives accordingly; they must turn their industry from a peace to a war basis, and they must see that every war demand has a prior claim to every peace demand." Now England's industrial energy is mainly devoted to the production of war supplies. Whole industries have been closed down and the laborers engaged therein have been transferred to war occupations.[1]

It was argued by many in England, as it is being argued by some in the United States, that to readjust industry in such fashion would be to decrease wages and profits and thereby render more difficult the task of paying taxes and subscribing to government loans. The fallacy of this notion was revealed by experience, however, for when labor was shifted to war industries and factories were rehabilitated for the manufacture of war supplies, it was found that wages and profits were quite as large as before. And what is the vitally significant factor, it was found that these wages and profits were earned in producing *things that could be used in the waging of the war*. The war supplies obtained by this diversion of energy represented clear gain in fighting strength.[2]

UNITED STATES WAR PRODUCTION INADEQUATE

While this country has been learning these lessons from the nations that have been through the fire we have also been acquiring some experience of our own. It was the general notion at the beginning of the war that if the government were able to secure the necessary funds from the sale of bonds and the raising of taxes, the purchase of the necessary materials and supplies would follow as a mere matter of routine. The utter fallacy of this idea is revealed in the figures made public by the war department on January 31, 1918. Exclusive of loans to our allies, the government plan-

[1] Mr. Brand's address, from which the above was taken, was delivered September 26, 1917, before the American Bankers' Association. Unfortunately the address was not published in full in the official *Journal of the American Bankers' Association*. The important parts were, in fact, omitted. The writer has a transcript of the stenographic report of the full address.

[2] To guard against misunderstanding here it should be stated that some luxuries are still manufactured in England; for England's reorganization is not 100 per cent efficient. Moreover, it must be observed that the manufacture of certain luxuries to be shipped abroad in exchange for necessities may within limits be wise.

ned to spend during the fiscal year ending June 30, 1918, $12,316,000,000. In fact, the government has spent in the seven months from June 30, 1917, to January 31, 1918, only about $3,150,000,000. That is, in seven-twelfths of the year the government has been able to spend only three-twelfths of what it planned to spend. With coffers filled to overflowing the government could not buy the supplies needed, for the simple reason that not sufficient energy had been devoted to the production of war supplies. Money alone was thus seen to be impotent; and this experience has focused attention on the real requirements for waging war, namely, materials and supplies.

These figures show more clearly than mere words could possibly do that the United States has thus far not accomplished anything like what it confidently expected to accomplish. They prove that we are falling far short of rendering our maximum aid. Moreover, it is concrete evidence such as this which has forced our government to conclude that we must resort to the second of the two alternatives stated above; that is, secure a thoroughgoing readjustment of industry.

It is possible, of course, that we may continue with present methods and still blunder through to victory somehow. It may be that Germany is nearly done. But the evidence of the past year all points to an opposite conclusion. Not since the first year of the war has Germany gained such marked successes as during recent months. We may bolster up our courage by tales of "strategic retreats," of occasional recaptures of lost ground, and of the rumblings of internal discord in the Fatherland; but when are the allies to have something positive to offer in the way of gains of their own? We have been saying for over two years that Germany is "about through," and all the time the evidence shows that she is getting relatively stronger, at least so far as the European forces are concerned. Indeed, with the disintegration of Russia we are at the gravest period of the war since the Battle of the Marne. And really effective aid on our part cannot be given until the year 1919 at best.

But even granted that victory is ultimately assured for the allies, it must never be forgotten that every month of prolongation of the war means billions of additional cost and the sacrifice of the lives of thousands of our finest sons. All will agree that consciously to leave any stone unturned to render our maximum service and to bring the war to the earliest possible successful termination is nothing short of criminal. The supreme requirement of the hour would seem to be industrial mobilization that will go to the very foundations of our national organization.

WHAT OUR GOVERNMENT IS PLANNING

The government of the United States is, as already indicated, now fully aware of the necessity of such an industrial mobilization as we have been discussing. It is important, therefore, that we all understand what developments are in store for us, to the end that we may co-operate in fullest measure with the government in its efforts.

First, the government is urging us to save as never before; and to save with a view to the elimination of nonessential industries. The Liberty Loan Committee states:

> Luxuries and extravagance must go completely out of fashion—should, in fact, be considered little short of treachery. . . . There is not enough capital, labor, transportation, or raw material to go around, if those industries which are not essential to the conduct of war are continued at their normal productiveness. Every unessential industry which continues in operation must be considered as bidding against the nation for its life's blood. . . . Every unessential industry which burns coal deprives the essential industries by just so much of the supply available for their purposes. Every man who buys a new overcoat is bidding against Uncle Sam, who is buying overcoats for soldiers. And every dollar spent on a luxury is helping to support an unessential industsry in the competitive consumption of essentials.[3]

But the government is not to rely exclusively on voluntary saving as a means of bringing about industrial changes. It is also developing agencies of central control. In September a priority committee was established in Washington with power to decide what industries should be given prior claims in the matter of raw materials. This committee has drawn up a classification, as follows:

Class A comprises war work: that is to say, orders and work urgently necessary in carrying on the war, such as arms, ammunition, ships, etc., and the materials required in the manufacture of same.

Class B comprises orders and work which, while not primarily designed for the prosecution of the war, yet are of public interest and essential to the national welfare, or otherwise of exceptional importance.

Class C comprises all orders and work not embraced in Class A or Class B.

There are various subdivisions of these classes, indicated by a suffix number, thus, A1, A2, etc., B1, B2, etc.

All orders and work in Class A shall take precedence over those in Class B, and those in Class B shall take precedence over those in Class C.

When rigidly applied to such fundamental materials as iron, it will be readily seen that this priority system reaches into nearly every branch of industry, and that people who wish iron and steel for ordinary industrial requirements will be forced to wait—and wait indefinitely, since the demands of the war industries are certain to be simply insatiable.

Very recent developments in connection with the problem of the nonessential industries may be indicated by quotations from a statement issued by the War Industries Board of the Council of National Defense late in February, 1918.[4]

> Shortages of many classes of raw materials and of labor in different lines are evident. Transportation, both water and rail, is obviously short and the need of industrial readjustment is apparent to make room for the war requirements of our government and our Allies. . . . In many cases, the facilities of less essential industries should be converted to essential production. . . . Our industrial equipment is limited. We do not have materials, machinery, transportation, labor, or capital sufficient for fighting the great war and for normal business at the same time. The war must be prosecuted to the utmost . . . and to that end business must, where necessary, be diverted from its established channels into new channels.

With reference to the coal situation, it is stated that—

> The demands for 1918 to carry out the program for the production of necessities for the war, in addition to the normal business, would greatly exceed any possible production and distribution of fuel, so there is but one remedy, i. e., to limit the production of non-war industries sufficiently to provide for:
>
> (*a*) War needs—direct and indirect.
>
> (*b*) Necessities for the public welfare and domestic consumption.
>
> In accomplishing the desired end, it should be our effort to divert the energies of non-war industries as far as possible to

[3] See *Economic World*, January 12, 1918, p. 54.

[4] This statement is issued by the Chamber of Commerce of the United States of America, as War Bulletin No. 34, entitled "Industry in War Times."

the production of the essentials for war, that each industrial center may use existing facilities, with its labor living at home, happy and contented.

In the readjustment process it is inevitable that the normal business of some industries must be interfered with in order that the production of war and public necessities be kept at the maximum. It may be that some plants because of lack of power, shortage of labor, raw materials, or transportation may have to suspend entirely. These sacrifices must be endured in the interest of our first object, which is to win the war. If we secure complete co-operation between Government and business, it is hoped that our industries may emerge from the disturbed condition caused by the war, intact and strong for the economic problems which must face us.

It would seem to be the immediate duty of the War Industries Board—

1. To list, by classes or otherwise, and to define those industries whose operation as a war measure are of *exceptional importance*, classifying them as far as practicable in the order of their relative urgency, measured by the extent of their contribution, directly or indirectly, toward winning the war.
2. To consider carefully, and, after due notice and hearings, to determine what are the less important industries, measured by the extent of their contribution, directly or indirectly, toward winning the war.
3. To promulgate such findings and to prepare, present, and, if practicable, enforce such definite and concrete plan or plans as will result in—
   (*a*) Stimulating the operation of industries of exceptional importance.
   (*b*) Curtailing the operation of the less important industries, or, in the alternative, encouraging such industries so to change their operations as to produce war needs.
   (*c*) Conserving the supply of essential raw materials as reserves to be drawn to meet the war requirements.

The task of bringing about the necessary reorganization with the minimum of loss and suffering is so tremendous that the machinery for its accomplishment is as yet far from being perfected. While the details cannot be given in this paper, it is generally known that the government is now developing the machinery for transferring laborers with a minimum of loss or suffering to the jobs in war industries for which they are adapted. Plans are also being matured which will provide for adequate housing facilities in the vicinity of war industries. Various financial policies are also being worked out which will insure that investments shall be diverted from the nonessential industries, and that businesses which transfer to war work will be given adequate financial support and a guaranty of adequate profits.

It should be added here that the rapidity with which this readjusting may be accomplished largely depends upon the developments in shipping. The materials and supplies for war must pass through a narrow-necked bottle on the way to Europe, and the rate at which this neck expands will determine the rate at which we can effectively mobilize our resources for war purposes. Now, to increase our shipping capacity as rapidly as is required involves not only speeding up the work in existing yards, but also enlarging our shipbuilding facilities by diverting labor and capital from less essential work. It means that parts of ships must be manufactured by industrial plants wherever readjustment for such work is practicable. It means, further, that imports and exports of nonessentials must be curtailed in many instances to the end that tonnage may be released for war business. And the restictions of these imports and exports in turn necessitates readjustments in the domestic industries dependent upon such trade; the labor and capital employed in such industries must be diverted to the production of forms of war materials to which they may be adapted. In short, the problem before us is nothing less than the organizing of all the productive resources of the United States of America with a single end in view—that of building a bridge of ships across the Atlantic and sending across that bridge in minimum time a maximum of troops and supplies. The task we are undertaking is thus one gigantic business proposition, in comparison with which the largest individual business ever known is utterly insignificant. To carry such a stupendous task to successful completion will require not only the best organizing ability the nation possesses, but infinite patience and willing self-sacrifice on the part of those whose ordinary occupations are inevitably to be disarranged.

HOW BUSINESS CAN HELP

It goes without saying that American business men are anxious to assist in every possible way in effecting these industrial readjustments with a minimum of loss. Patriotic impulse alone will lead every American business man to do his part. He merely needs to be shown how he can help most efficiently. But quite apart from patriotism or the possibility of a curtailment of raw materials or transportation facilities there is another reason which should lead business men to make readjustments wherever possible just as quickly as they can. It is inevitable that the nonessential industries will shortly have greatly reduced sales; indeed, in many cases there is already a serious falling off in sales. The reasons why this is inevitable may be briefly indicated.

In the first place the perfect barrage fire of argument as to the necessity of saving that has been hurled at the American public in recent months is bearing fruit. It is now regarded as unpatriotic not to save as never before in our history.

In the second place it is impossible for the rank and file of the American people to buy Liberty Bonds and spend as usual. If they buy bonds it must be at the sacrifice of accustomed luxuries. Moreover, we are now looking forward to the payment of taxes, and we are making our preparations for this by economizing in our normal purchases. It must be borne in mind in this connection, also, that at a time when the future is so uncertain a great many people are saying, "I had better save all I can now, because there is no telling whether it will be possible for me to save anything in the next few years."

Finally, it must be noted that the rapid rise of prices in nearly every line is *forcing* rigid economy among the masses. Statistics just published by the government show that retail prices of foodstuffs in the United States are now 57 per cent higher than they were in 1914, while general wholesale prices are 81 per cent higher. Students of the question are unanimous in the belief that prices will continue to rise here throughout the war, just as they have in the nations of Europe. It will therefore shortly be impossible for the masses of our people to devote much of their earnings to the purchase of nonessentials. They will count themselves fortunate if they are able to purchase enough of the necessities of life to sustain themselves in a state of normal efficiency. Already in many cases the pinch of war prices is beginning to mean real privation.

In the light of the situation which we have been discussing it is obviously imperative that business be readjusted to a war basis wherever practicable and as soon as possible. The great problem is, How? There are two attitudes which business men may assume. One is that of "watchful waiting"; the other that of

active and constructive effort directed toward conversion of their plants to war manufacture. The former leads to bankruptcy and to neglected opportunity for service to the government; the latter is the avenue to participation in profits and to effective assistance to the nation in its hour of need. A large number of concerns have already been forehanded enough to divert a portion of their plants to war work; and it is hoped that the facts about these may soon be made generally available. In the meanwhile it may prove suggestive to present here a very brief statement of some of the adjustments that have been made in England. Instead of gramophones, the gramophone company now makes fuses and delicate shell parts; instead of cloth for ordinary clothes, the woolen factory makes khaki; instead of motor cars, the motor-car maker makes shells; glaziers make cartridge clips; music-roll plants make gages; infant-food plants make plugs for shells; advertising agencies make shell adapters; watchmakers adjust fuses; baking-machinery plants make six-inch high-explosive shells; jewelry houses make periscopes; cream-separator factories make shell primers; and textile machinery firms make field kitchens.

The outstanding need of the time is for the managers and staffs of technical experts in non-war industries everywhere to be studying the problem with the greatest care in order to discover in what ways their plants may be adapted to war production. They should, moreover, actively co-operate with the agencies in Washington which, under the appointment or approval of government, are wrestling with the problem of industrial readjustments. On the manufacturing side there is the Bureau of Manufacturing Resources of the Council of National Defense, which is giving its attention to the problem of plant conversion. On the commercial side there is the Commercial Economy Board of the Council of National Defense, which "has undertaken to co-operate with business men * * * in eliminating needless uses of men, materials, equipment, and capital in all lines of commercial business." Business men who desire to place themselves in line with this movement may very properly enter into correspondence with these agencies. Such correspondence may well have the double result of proving helpful both to the business interests and to the governmental committees themselves. There is opportunity here for some really constructive co-operation.

I think it is not putting it too strongly to say that the outcome of the greatest struggle in history for the rights of a common humanity very largely depends upon the rapidity and the effectiveness with which American business rises to the task before it.

Merger Plan in San Diego

Formal merger of the San Diego Home Telephone Company with the Pacific Telephone Company in San Diego, Cal., is to take place, provided the United States Department of Justice and the State Railroad Commission will consent to the plan.

Proposed consolidation of the two concerns, giving San Diego one telephone system instead of two, was publically announced before the City Council by representatives of the Home Company. The Council endorsed the plan.

Melville Klauber, president of the Chamber of Commerce, appeared before the Council with the Home officials and urged that the Council adopt a resolution favoring the merger. Klauber filed with the Council a resolution passed by the Chamber of Commerce directors endorsing the consolidation, on the grounds that one telephone system in San Diego will be more convenient and satisfactory to the business interests of the city. It was set forth in the chamber resolution that the burden of supporting two telephone systems is more than the people should carry.

Councilman Howard B. Bard moved that the city attorney be called upon to draw up a resolution favoring the consolidation. The motion carried. This resolution passed by the Council will be forwarded to the United States Department of Justice and the State Railroad Commission, which bodies will be asked to sanction the merged in the near future.

It was announced that a majority of the bondholders of the Home Company favor disposing of their interests to the Pacific Company as it appealed to them as the best method by which to realize something on their investment. It was said that the Home Company cannot make bond interest and that it cannot develop the system to meet the demands made upon it without raising rates, which would be impractical.

Injunction Stops Michigan Merger

Plans of the Union Telephone Company and the Michigan State Telephone company to merge in Gratiot and other central Michigan counties has been indefinitely held up and delayed by an injunction secured by the Valley City Telephone Company of Saginaw, the Independent company operating in that city.

The plans of these two companies have been going on for about two years and it had been expected that the proposition would be put through within the next few weeks, when the injunction called a halt in the proceedings which will hold up the merger for a time at least.

The Union and Bell interests had a petition ready to file with the state railroad commission seeking permission to exchange and purchase certain of the exchanges and toll lines in several of the central Michigan counties.

It is understood that the deal to be made would transfer from the Bell system to the Union, all of its exchanges in portions of Mecosta, Isabella, Montcalm, Gratiot, Saginaw, Ionia, Clinton and Shiwassee counties where the Union Telephone Company now operates. The deal would place with the Union company approximately 3,500 telephone stations and 750 miles of toll lines. With this addition the Union Telephone company would operate about 15,000 stations and 2,800 miles of toll lines.

The Union company also desires to sell and exchange with the Bell company all of its exchanges, toll lines and toll stations in Clare, Midland, Bay and Genesee counties. The Bell company would buy approximately 1,500 telephone stations and 275 miles of toll circuit. The Union company would pay to the Bell company $126,000 in addition to the property which it would turn over to the Bell company for its property.

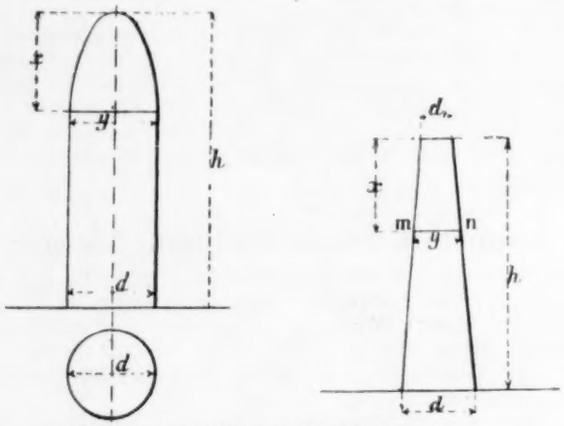
General Manager W. J. Melchers of the Union Telephone Company stated that while the injunction had tied matters up for the present, there was little question that it would finally be ironed out and the deal go through. He stated that a $22,000 switchboard has already been purchased for the combined office that the company will have in Alma when the deal goes through. He also stated that much more material had been purchased with the expectation that the deal would be closed shortly as the injunction had not been looked for.

European Telephone Practice

Translations from the Foreign Press and Communications from European Engineers

BY FRED W. SCHOLZ

THE MECHANICAL RESISTANCE OF WOODEN TELEPHONE POLES.—It may seem superfluous to treat a question which at first glance belongs clearly in the realm of pure strength of materials and presents no particular point of contact with other questions. But as a matter of fact, nothing could be further from the actual facts, for many a time the author has seen engineers hesitate and be in doubt as to the disconcerting results which



Figs. 1 and 2. Ideal and Real Telephone Poles.

they reached by the use of the usual theoretical formulae, when computing the resistance and strength of poles. Moreover, when actually constructing a pole line, many an engineer is likely to forget the numerous calculations that he has to make and thus neglect some of the points that should always be considered when working on a pole line. Besides there is one point which is almost always neglected, and that is the resistance of the soil. When we recall the large number of telephone and telegraph poles that are curved and inclined, without seemingly having to stand any force sufficient to bring about this curvature, it is evident that the trouble lies at the base of the pole and that the resistance of the ground around the pole was not studied sufficiently to give adequate support to the pole. However, to study every type of pole used in constructing telephone lines would lead us too far astray and therefore this discussion will be restricted to the wooden poles which after all are the ones most frequently used.

1. *Simple Poles.*—The ordinary telephone pole has to support: 1, horizontal forces and stresses caused by the tension of the conductors and the wind; 2, vertical forces caused by the weight of the wires or cables, by snow and frost, finally by the weight of the pole itself which is above ground.

The vertical forces give rise to a component which makes the pole resist compression; the horizontal forces give a resultant which, having its point of application at the top of the setting, makes the pole tend to bend; these are the forces which in reality determine the cross section to choose for the pole, which react and work against the soil in which the pole is set and which are the most important ones to be considered.

If the line does not form an angle, if the adjacent spans are equal in length, the horizontal forces due to the tension of the conductors and cables will neutralize and annul each other; there remains only the force of the wind to be considered. If, on the contrary, the line is not straight, the force of pull or traction exerted by the conductors will give rise to a resultant which must be considered and to which is added the force of the wind.

We are going to see first of all what the resistance of a pole to bending amounts to and then we will apply this in a practical case. A pole reacts to bending stresses like a piece of material which is free at one end and held at the other; it has the shape of a tapering cone and theoretically considered, approaches that ideal solid of uniform resistance, in which, no matter what the transverse section may be, the maximum load per unit surface will always remain the same. Now we know that if a solid surface, supported at one end, has a circular section of diameter d at the place of support or setting and a free length h, the profile of the solid of equal resistance is determined by the condition, which the diameter y of any section situated at a distance x from the free end (Fig. 1) would have for the value:

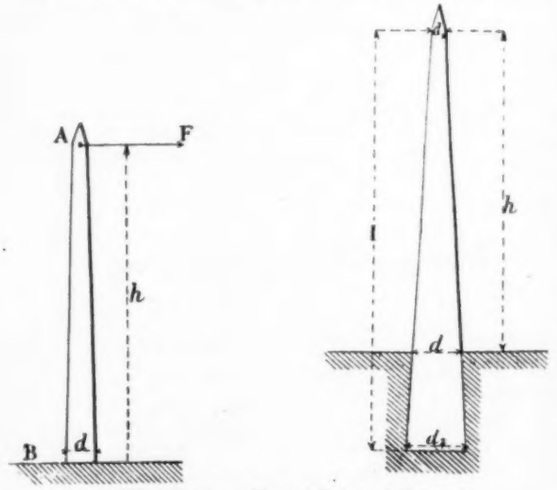
$$(1) \qquad y = d\sqrt[3]{\frac{x}{h}} = d\left\{\frac{x}{h}\right\}^{\frac{1}{3}}$$

Let us now consider instead of this ideal pole, the real telephone pole, whose longitudinal section is a trapezium (Fig. 2) and in this pole some section mn, which we will designate by y, situated at a distance x from the top of the pole. We will then have:

$$(2) \qquad y = d_1 + x\frac{d - d_1}{h},$$

d and d_1 being the respective diameters of the pole at the base and at the summit.

What will be the value of x for which the truncated



Figs. 3 and 4. Normal Types of Poles.

pole will have the same resistance as the ideal pole? This value will be determined by the fact that in the section considered, the profiles of the two poles will be tangents;

it will be sufficient to state that at this point the tangents coincide. Now the value of these tangents is immediately obtainable by differentiating (1) and (2) with reference to x which will give:

$$(3) \qquad \frac{\delta y}{\delta x} = \frac{1}{3} d \left\{\frac{x}{h}\right\}^{-\frac{1}{3}}$$

$$(4) \qquad \frac{\delta y}{\delta x} = \frac{d - d_1}{h},$$

Let us then set (1) equal to (2) on the one hand and (3) equal to (4) on the other hand, and we will have:

$$(5) \qquad d \left\{\frac{x}{h}\right\}^{\frac{1}{3}} = d_1 + x \frac{d - d_1}{h},$$

$$\frac{1}{3} d \left\{\frac{x}{h}\right\}^{-\frac{2}{3}} = \frac{d - d_1}{h},$$

and then let us divide these two new equations by each other and we will find: $x = \frac{1}{2} \frac{d_1}{d - d_1} h$. If we set $x = h$, we will have: $\frac{1}{2} \frac{d_1}{d - d_1} = 1$, and from this: $d = \frac{3}{2} d_1$, which shows that: The section of breaking or rupture is that, whose diameter is 3/2 of the diameter of that section, where the force is applied.

It is always of advantage from the point of economy, that the section of break or rupture be located at the level of the ground. Such a pole constitutes a "typical pole." It represents a standard type; it allows us, with the same volume of wood, to apply at a delnite height above ground, the greatest horizontal force possible under normal conditions. If the rupture or breaking section is above the ground level, the pole, looked at merely from the viewpoint of resistance, is too long for all practical purposes. If this breaking section is below ground, since it cannot be within the pole setting itself, it will have to approach the level of the ground as near as possible and the pole is then too weak to resist the maximum force exerted against it. We may then make the statement: that the diameter at the base, i. e. at the setting of the

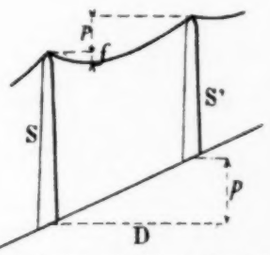


Fig. 5. Forces Exerted on Poles in Uneven Terrain.

pole, should be as near as possible to 3/2 of the diameter at the head, which is readily carried out with the general type of pole now on the market.

Let AB (Fig. 3) be a pole, A the point of application of the horizontal resultant effort F, h the height or distance from point A down to the ground, d the diameter of the pole at the setting, i. e. at the ground level; finally I the moment of inertia of the pole section at the setting, n the distance between the fibres mostly strained by the bending stress to the neutral fibres and R the practical load or safety load which must not be exceeded.

The greatest possible moment tending to bend the pole at B will be equal to Fh; on the other hand the maximum bending moment admissible has a value of: $R \frac{I}{n}$.

We can then write: $Fh = R \frac{I}{n}$. But the cross section being circular and of the diameter d, we have: $\begin{cases} I = \frac{\pi d^4}{64} \\ n = \frac{d}{2} \end{cases}$

By replacing in equation (5) I and n by the values given above, we have: $Fh = R \frac{\pi d^3}{3_2}$, and hence: $R = \frac{3_2 Fh}{\pi d^3}$. If we admit that $\frac{3_2}{\pi}$ is sensibly equal to 10, which is sufficient for practical purposes, we reach the classical or standard formula or simplified equation:

$$(6) \qquad R = \frac{10 Fh}{d^3}.$$

Now, as in practice R must never pass beyond a maximum of 0.6 kg/sq. mm. (852 lb. per sq. in.) (coefficient of

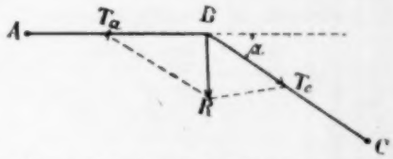


Fig. 6. Telephone Pole Line with Curves.

security = 10), we can deduce that in practice we must always have:

$$(7) \qquad F < 0{,}06 \frac{d^3}{h}$$

This gives the maximum effort at the head of a pole of diameter d (at the base) and of height h (the height being estimated from the ground level to the point of application of the resultant of the horizontal forces).

It is easy to simplify this equation still further by noting, that the diameter in normal poles of 9 to 12 m. length (29.7 to 39.6 ft.) is a function of their length; as a matter of fact, when we refer to the following table, giving the characteristics of the commercial poles used, we will see that the diameter at the head is usually equal to about 1.5 per cent of the height, and the diameter at the base equal to about 2.1 per cent of the height. This gives a pole which is less strong than the "standard type," discussed before. The rupture or breaking section set in the soil often varies between 15 and 16 per cent of the length.

Table of Values.

Total Length:	Meters:	8	9	10	11	12
	Feet:	26.4	29.7	33	36.3	39.6
Diameter at Top:	Meters:	0.13	0.14	0.15	0.16	0.17
	Inches:	5.1	5.5	5.9	6.3	6.7
Diameter at Base:	Meters L:	0.17	0.19	0.21	0.23	0.25
	Inches:	6.7	7.5	8.2	9.0	9.8

Now an examination of Fig. 4 will show, that d being always the diameter at the setting, d_1 the diameter at the head, d_2 the diameter at the base, we will have the equa-

tion: $d = d_1 + \frac{h\,(d_2 - d_1)}{L}$. But: $h = L - 0{,}15\,L$.

Hence: $L = \frac{0{,}85}{h}$. And:

$$d_1 = 0{,}015\,L = \frac{0{,}015\,h}{0{,}85} = 0{,}0176\,h$$

$$d_2 = 0{,}021\,L = \frac{0{,}021\,h}{0{,}85} = 0{,}0247\,h$$

When replacing L, d_1 and d_2 by these values in (8) we will have $d = 0{,}0236\,h$. Let us bring over into equation (7) this practical value of d and we have:

$$F < 0{,}000\,000\,79\,h^2,$$

which is approximately: $F < 0{,}000\,000\,08\,h^2$.

This equation, though empirical, but extremely simple, shows that: the maximum admissible horizontal force, in absolute values, applied at the head of a wooden pole of normal proportions, increases as the square of the height of this pole above ground. It is therefore inaccurate to say, as is often done, that shorter poles are more resistant than longer ones.

The following table sums up the values of the maximum forces F for the ordinary commercial poles, running between 7.50 and 13 m. (24.7 to 42.9 ft.) height above ground (equal to a total length of 9 to 15 m. (29.7 to 49.5 ft.) with a coefficient of security equal to 10.

Table of Values of Poles.

Values of h (height above ground):						
Meters:	7.50	8	8.50	9	9.50	10
Feet:	24.75	26.4	28.05	29.7	31.35	33
Meters:	10.50	11	11.50	12	12.50	13
Feet:	34.65	36.3	37.95	39.6	41.25	43
Values of F:						
Kg.:	45	51	58	65	72	80
Lb.:	99	112.2	127.6	143	158.4	176
Kg.:	88	97	105	115	125	135
Lb.:	193.6	213.4	231	253	275	297

Let us see, now that we know the mechanical resistance of poles, what results the cables that they have to support produce on them in actual practice and what influence the force of the wind has on them. To discuss this, we have to take two separate cases: poles set in a straight line and poles set at an angle or in a curve.

In case of straight line poles, if the adjacent spans are equal, as is the case ordinarily, and if they are equally stretched, the horizontal forces due to the tension balance and annul each other and there remains only the force of the wind, which is at the maximum in a direction perpendicular to the line. Of course it is understood that we have in mind a problem where the telephone line goes through flat country; in an uneven and hilly country, as a matter of fact, the poles are stressed unequally on the two sides, as shown by the arrows in Fig. 5. For the pole S the value of the sag is f and for the pole S^1, which is at a slightly higher elevation, the value is $f + p$.

However, the difference in pull is only small and has been figured out to be somewhat near $0.009\ p \times s$, where s is the cross section of the line in sq. mm. and p the difference in height between the two adjoining telephone poles, expressed in meters. One can neglect this factor except in exceptional cases.

Now coming back to our previous discussion, we can give a clearer account of the value of the efforts exerted by taking as example the case of a line with 4 conductors of 38 sq. mm. (0.057 sq. in.) cross section with standard poles of 12 m. (39.6 ft.) height, set in the soil to a depth of 1.80 m. (5.9 ft.) and spaced at a distance of 50 m. (165 ft.)

The worst wind allowed in the usual computation is one of 72 kg., i. e. a wind producing a pressure of 72 kg. per sq. m. (14.4 lb. per sq. ft.) upon a plane normal surface. Now a cable of 38 sq. mm. (0.057 sq. in.) has a diameter close to 7 mm. (9/32 in.); admitting, that the sag of the wires will increase the length a little, and that the four cables are spanned between poles in such a way that the wind will have a minimum of force to spend on them and then in reality only on two of them, the horizontal effort on each pole, resulting from the action of the wind on the cables will be:

$$2 \times 50 \times 0.007 \times 72 \times 1.05 = 52.92 \text{ kg.}$$

On the other hand the wind also acts on the pole itself; a normal pole of 12 m. (39.6 ft.) length, having a length of 10.20 m. (33.66 ft.) above ground, being 0.18 m. (7.07 in.) at the top and 0.25 m. (9.8 in.) at the base, will support a pressure equal to:

$$\frac{0.18 + 0.25}{2} \times 10.80 \times 72 = 167.18 \text{ kg.}$$

This force is applied at about the middle of the pole and from the viewpoint of sagging moments, one can evaluate it with about half of this last value, namely 83.6 kg., which pressure is applied at the top.

The total effort which the pole will have to sustain in reality from the force of the wind will be at the highest: 52.92 + 83.6 kg. = 136 kg. If we take this to apply to each sq. ft. of surface, we have a pressure of 27.2 lb./sq. ft. We can conclude from this, that a pole of standard length of 12 m. (39.6 ft.), which, figuring on a coefficient of security of 10, is able to stand a pressure of 85 to 90 kg. (17 to 18 lbs. per sq. ft.), and is just right for a two-phase line of 38 sq. mm. (0.057 sq. in.), when the four cables are twisted in double strands and give the wind the action as on two only, having about the same sag. However, in actual practice a coefficient of security of 5 is taken as being sufficient, which doubles the figures given in the previous account. If then we assume, that the sag of the cables is not identical, which gives a supplementary effort due to the wind of 53 kg., and therefore a total effort of 189 kg. instead of 136 kg., it is obvious that we still remain within the required safety limits.

Let us now examine the case of a line which is somewhat curved, like the line A, B, C, (Fig. 6).

A pole such as B will have to support outside of the strain of the cables, the force of the wind, which will be maximum when its direction is equal to the resultant R of the forces T_a and T_c due to the tension of the conductors of adjacent spans.

Now the tension T is a function of the span l, of the sag f and of the weight p per running meter of conductor; this is given by the standard formula $T = \frac{l^2 p}{8f}$ and one must choose l (the span) and f (the sag) such that there will be ample safety. The abacus worked out by Blondel permits the choice of l and f, so that the tension T shall not pass beyond the factor of safety. This is known in advance and this, added to the force of the wind must not go beyond the limit of load which the normal pole can stand.

The calculations offer no difficulties; we need merely add that they must be made for the lowest temperatures that are ever found in the regions through which the pole line runs; after that it can be verified, to make sure that

the sag by the conductors at the highest temperatures is not beyond reason.

Let us now examine the stresses produced by the vertical forces; these are only too often considered as being negligible, which is entirely wrong. In reality, if we take account only of the compression forces in the strict sense of the word, one can derive the formula as follows, when the resistance to crushing on the part of the fir pole is 0.6 kg./sq. mm. (852 lb./sq. in.) with a coefficient of security of 10, taking a normal pole of 12 m. (39.6 ft.) whose top has a diameter of 0.17 m. (6.7 in.):

$$\pi \times 85^2 \times 0{,}6 = 13\,610 \text{ kg.}$$

But a wooden pole, whose length is very great when compared to its transverse cross section is subject to a compression force, which is expressed by the bending of the pole between the top, where the vertical forces are applied and its setting in the soil. It is therefore necessary to modify the coefficient of security in accordance with the various equations which have been found either theoretically or through actual experience. One of the simplest of the equations, and one which gives very true results for the cases coming in question in this discussion is that of Euler: $F \angle \frac{\pi^2 EI}{4l^2}$, in which: E is the coefficient of elasticity of the wood, the value of which for fir lies between 900 and 1,000, I the minimum moment of inertia of the transverse section and l the length of the pole (above the ground).

In applying this to a normal pole of 12 m. length, being 0.17 m. diameter at the top and 10.2 m. above the ground, we have: $F \angle 970$ kg. This is the vertical load at the head which must not be passed with this type of pole, if its safety factor is not to be exceeded.—(to be continued.) A. Delamarre, *Revue Généale de l'Electricité.*

Shortage of Materials and Substitutes in Germany

THE French paper *Revue Générale de l'Electricité* has an article discussing the shortage of electrical materials in Germany and Austria, and the substitutes that have been used, partly successful, for the old materials.

The shortage of certain materials grew so acute as far back as the early part of last year, that strenuous efforts had to be made to find substitute materials, whose source of supply lay within the realms mentioned.

As soon as materials began to run short, the empire founded a bureau for the delivery of war materials (Metall Freigabestelle), where those individuals and firms that had certain raw materials to deliver could bring them, and then these materials were redistributed to the industries where there existed a shortage. This bureau was established within the buildings of the Zoological Park at Berlin and in addition an exposition for various substitute materials (Ersatzstoffe) was arranged, which showed how the substitute materials could take the place of the "economy-materials" (Sparstoffe). The different technical associations of Germany, such as the Society of Electrical Engineers, the Mechanical Engineers, the Mining Engineers, the Foundrymen's Associations, etc., gave their aid in this enterprise. More than 80 large firms and a large number of small ones participated in this exposition, among them the electrical, mechanical, automobile, metallurgical, mechanical machines, optical instruments and other industries. The exposition is to be kept open throughout the war. In order to visit it, one needs a personal card of introduction and admission and each visitor is pledged not to reveal anything he has discovered at the exposition and to use nothing for his own industry or his own firm, but what is absolutely needed for carrying on his work. Nor must he exploit some suggestion he received at the exposition for commercial gains.

Numerous suggestions were made by the office in charge of this bureau of materials, with the viewpoint of saving materials as much as possible. Some of the more interesting among these suggestions are the following:

The number of reserve parts of machines must be reduced down to the minimum number possible.

No new pipes, tubes or mains must be laid anywhere, except in cases where the old ones leak badly and would bring about a greater loss of material sent through the pipes, than is equal to the cost of the new mains.

In distribution systems, where formerly double systems of bus-bars were used, only one system is now to be employed.

In the matter of meters, of counting and recording devices either for electric current or operated by electric current, only one instrument must be used, where previously more than one was used. The number of such instruments must be reduced to the smallest possible factor.

To replace the platinum in those contacts where breaks are brought about and where deteriorations are feared owing to the action of electric sparks and arcs, one can use an alloy of silver and palladium. Good results have been obtained with such a substitute, containing only 2 per cent palladium. If the contact is exposed to the action of sulphur vapors at least 5 per cent palladium must be used.

An alloy having 60 per cent palladium and 40 per cent silver has given the best results as a resistant to the action of sparks. The melting point of the alloy increases as the percentage of palladium rises and at the same time the heat conductivity decreases; thanks to the heat conductivity of silver the heat due to the production of sparks is quickly dissipated before the melting point is reached.

The central powers are continuing to replace the copper windings of electrical machines by aluminum wire. At the beginning of the war aluminum was very scarce in Germany and was requisitioned. But it seems that since that time they have learned how to reduce aluminum from large bauxite deposits found in the Vogelsberge in Hesse. Iron and zinc have also been tried for substitutes for the windings and coils but with less success than with the aluminum. Tests and investigations made with the new windings as against the old copper windings have shown that the aluminum windings give practically the same power to the machines as did the copper ones. The price is also almost the same as with copper, in some cases even less and it has been suggested that aluminum might still be used after the war for windings, taking the place of copper which is now commonly used for this purpose. The results are less favorable for zinc and still less so for iron windings.

The following table gives a partial summary of the old and the substitute materials that have been adopted for various electrical constructions:

Apparatus and Construction:	*Old Materials:*	*Substitute Materials:*
Overhead conductors	Copper (wires, cables)	Iron; iron cables, zinc aluminum.
Telephone Poles	Sublimates, tar oils	Sublimates of sodium, soda with crude creosote, sodium fluoride with dinitrophenol.
Telephone and telegraph conductors	Copper and bronze	Iron with Pupin coils.
Suspension insulators (high tension current)		Forbidden
Wires and cables for low tension currents	Copper with cotton insulation	Zinc, aluminum, paper, paper fibre.
Fuse wires	Copper	Iron, zinc, silver wire.
Windings	Copper and cotton	Zinc, aluminum, paper.
Generator brushes	Ceylon graphite	Native graphite, carbon with other materials added.
Mechanical parts	Nickel steel, bronze	Manganese steel.
Lubricants	Oils	Oil and graphite, solution of potash.
Magnets	Tungsten steel	Chrome Steel.
Resistances	Alloys of nickel	Alloys of manganese.
Terminals	Copper, brass	Iron; for high tension current: copper, brass.
Electromagnets	Copper windings	Zinc, aluminum windings.
Contacts	Platinum, bronze	Palladium alloys, rhodium alloys, silver and palladium, steel.
Low tension current insulation materials	Ebonite, rubber, oil, varnish	Futuran; bakelite, other artificial insulation materials; varnish of acetate of cellulose.
Protection against rusting	Nickelplating, tinplating	Cobaltage, zinc plating (new processes).
Protection against rusting	Enameling, painting	Varnishing with acetate of cellulose.
Welding and soldering	Tin	Cadmium and autogenous soldering.
Hardening materials (lead)	Antimony	Calcium, sodium.
Pipes for oil and cooling water	Copper, brass	Paper, celluloid.

Telephone Communication Under Fire

THE following is an extract from a letter written by a member of the British signal corps, who took part in some of the battles late last year:

" . . . I have been very much surprised to see how little mention is made in the press of the telegraph and the telephone and its work in the present day campaign. In time of war the signal companies of the Royal Engineers are among the most necessary members of the army. They are the nerve centers of the army.

"Most of the important towns in the north of France, as also London and Paris are in direct communication with headquarters. These telegraph and telephone lines are along the principal roads of communication and day and night there passes over them a stream of ambulances, of artillery, of remounts, of munition trains. From great headquarters there radiate in all directions the wires that communicate with the different corps of the army. Each army is divided into divisions and each division into brigades, all of which have their own wires. It is obvious that in the space of a few minutes the war department can be informed about what is going on at any place of the great battle line. As the headquarters are frequently moved, it is important to keep in constant communication with the same. For this purpose a detachment having two trucks is used; one section of the detachment lays the temporary line, while the second one remains behind to roll up the line, when the permanent line has been established.

"A division may receive sudden orders to depart at once to some new position, the extremity of the cable is joined to the permanent line, which communicates with headquarters and the signal detachment goes off on a trot into the open country, through villages and past columns of troops. The white and blue uniform of the Signal Service opens a road everywhere. A mounted man rides behind the cart with the cable and by means of a forked pole throws the cable off into the ditch on the side of the road or pushes it among the hedges to avoid accidents to the line when the troops pass over that road. Other mounted men remain further behind and they attach the line and connect it. In the truck is a telegraph operator who is constantly in connection with headquarters, while the cable is rapidly unrolled. If an orderly brings an important message the truck stops, the message is sent and then continues on its way.

"In general the Signal Corps does not do the fighting, but at Cateau the situation was so critical that the members of this corps were sent into the trenches to help repel an attack.

"The telegraph and telephone operators are often left alone in trenches, in isolated farm houses, hay lofts, etc., situated near the firing line. You can imagine how hard it is to concentrate on sending and receiving messages with the unearthly roar of the artillery, the shrieking and bursting of shells all around.

"One such adventure happened to me some time ago in an isolated chateau near the Ypres-Menin road. During an entire week this chateau was shelled by German artillery and was the center of a terrible fire until it became untenable and was abandoned by the staff. The general however ordered one operator to remain behind and transmit any messages that might be sent by the other brigades. I was picked out for that purpose and for a day and a night I remained in the chateau, constantly exposed to the German fire.

"The second day the Germans entered our trenches and the wires were cut by a shell. I received the order to evacuate the castle and to destroy the instruments. But I saved them by burying them in a shell crater. I had to save myself then by running across a field exposed to fire both of our own and of the enemy's. At the end of the same day one of our detachments was cut off and a second one captured by the Germans along with several reels of cable, but was retaken again by our own men after a hard struggle.

"In the region of the Aisne, where the country is wooded and hilly it is easy for spies to connect branch wires to our own telephone lines. The wires are constantly inspected by mounted men, whose service is

very risky. One day one of these patrols in making his rounds perceived that there was a quantity of cable placed on the side of the road. Dismounting to roll it up and save it, he was surprised to find a reserve wire attached to the principal line. In following up this line he found it to lead to a grain mill. Here a branch ran off towards the British headquarters. Then mounting guard over the mill, he awaited an armed troop who discovered a spy hidden in the mill.

"Wireless telegraphy naturally also plays an important role in the war. Most of the large aeroplanes have a wireless equipment on board by means of which they communicate intelligence to their headquarters. The Germans also use wireless equipments extensively in their field service."—*Annales des Telegraphes et Telephones.*

Interstate Commission Appraising A. T. & T.

The American Telephone and Telegraph Company is the next big concern on the valuation program of the Interstate Commerce Commission. It will be appraised as soon as the Western Union valuation is completed and the Postal Telegraph appraisement, ordered last month, is well under way.

The entire valuation program, it was said in the commission's office, is based on the supposition that government ownership of all telegraph and telephone lines is coming. Secretary McGinty, of the commission, declared the order regarding the Postal Telegraph companies, forty-three in all, was drawn up with no mention of government ownership having been made.

He admitted, however, that the original valuation effort, in the case of the Western Union, was based on congressional direction, with the idea of ultimate government ownership. Whether or not government ownership is in immediate prospect, he added, the commission will push the appraisement work as rapidly as possible.

If recommendations of Postmaster General Burleson finally prevail and Congress and the President decide to take over the telephone and telegraph lines, the commission will have a basis laid on which compensation can be arranged. Judge C. A. Prouty, director of valuation, will have charge of the work on the Postal Telegraph system, and later on the American Telephone and Telegraph Company.

Government ownership, proposed repeatedly by Burleson in his annual reports to Congress, is winning several strong advocates in the administrative branches, although Congress has shelved the successive reports made by the Postmaster General. The Railroad Administration, it is understood, may have something to say in favor of Government control when the proper time comes. Director General McAdoo's staff has found the telegraph business almost inextricably interwoven with the railroad systems. The wire companies lease hundreds of miles of wire from the railroads, and are forced to send thousands of messages over railroad wires at special toll rates. The roads, on the other hand, rent many hundreds of miles of wire from the telegraph companies.

The Railroad Administration, or at least some of its officials, feel the railroad business could be conducted much more efficiently if the Government controlled the telegraph lines.

Several other Government departments are leasing hundreds of miles of wire from the various telegraph and telephone companies. The Shipping Board, War Trade Board, War Industries Board, and of course the War and Navy departments, do a tremendous leased wire business. To date, there has been no centralized bureau established to handle all the wire leasing for the government. Each separate branch deals with the companies for itself. The belief is growing that if the Government could take over the wires, or at least concentrate its dealings with the wire companies, much money could be saved.

Postmaster General Burleson's next move in favor of Government ownership can not now be forecast, but it is expected he will have support from other cabinet members.

Demand for Telephones in Denver

Real estate men say there was never before such a demand for houses to be had by Denver renters. Their rent books provide an unfailing barometer to city prosperity, but the public utility reports more than bear out the realtors.

The telephone company in particular is having its troubles trying to satisfy the demand for telephones. It has a waiting list of more than 600 and it takes an average of forty days between the time the order is put in and when the telephone can be installed. Business men have been known to pay a bonus of several dollars for information concerning a telephone that is to be dropped in order that it may be switched to their place of business, they hoping to get first call on the service in this way.

Ten years ago the telephone company installed a plant that it deemed would be sufficient for Denver's growth for from twelve to fifteen years ahead. Nearly three years ago it began to see that its equipment would be overtaxed, and put in orders for new switchboards that would carry the city forward all of ten years by nominal rate of growth. Along about the time the new switchboard was ready for Denver, the government began hunting switchboards for its cantonments, and the one that was to go to Denver went to Camp Cody instead. It is in the federal service now, and Denver people are having to wait for their telephones.

Here and there the country over the company is now and then able to pick up a little equipment to help out in the emergency, and so is taking care of the demand in a remarkably good way considering the pressure. Last month space was made for fifty new telephones through getting a small piece of equipment extending the switchboards, but with four branches and the main office to be extended, the little it is able to pick up does not go very far toward relieving the unprecedented rush for new telephones resulting from the city's growth in population.

Demand Classified Directory

Topeka, Kas., business men at the Chamber of Commerce protested the announced action of the Southwestern Bell Telephone Company in eliminating from its Topeka directory the classified business section.

A. J. Mackey, local manager for the company, stated that the elimination of the classified section is due to the high cost of materials and printing.

It has suggested that the business men might stand a part of the cost of the directory, although the book has gone to press and it probably would be necessary to print a supplement to take care of the information wanted.

The telephone company suggests that subscribers tear from the present book the business directory and keep it for reference. Few changes in business telephones will be made during the year.

Public Utility Commission News

Reports Concerning the Activities of State Regulating Bodies in the Telephone Field

Alabama

FOR messages originating at telephones connected with either of the Florence or Sheffield exchange, and terminating at telephones connected with the other exchange, the commission orders that a charge of five cents for each connection of five minutes duration, or fraction thereof, shall be made by the company, the calls to be handled on the "two number" toll basis.

California

In the situation which now confronts many of our public utilities the duty of the State commissions is clear. While providing for the continuation of adequate service, it is their duty to act promptly and vigorously on applications for increased rates based on increased operating costs.

Where the usual methods of rate making would result in unreasonable delays, short cuts must be applied to meet the emergency conditions.

Our public utilities must be kept in a sound and healthy financial condition, so that they will be able to meet not merely the requirements of their existing patrons but also the additional requirements of the war.

The State commissions should not wait until the utilities come to them with their pleas for assistance. It is their duty to inform themselves by their own investigations, if necessary, concerning the condition of the public utilities under their jurisdiction and to keep themselves constantly informed.

If the State commissions rise to meet the situation, as they are doing in all sections of the country, they will be rendering a substantial service not merely to the utilities and their patrons but also to the nation itself, which is largely dependent for war efficiency on the service of public utilities.—*Max Thelen, President California Railroad Commission.*

After two years of work since the telephone rate case was begun before the State Railroad Commission, the Pacific Telegraph and Telephone Company has submitted to the commission its valuation of its San Francisco district properties involved in the case as $31,000,000.

Together with the properties in Los Angeles and a few other parts of the State not involved in the pending case the company officials say this figure indicates a valuation of $55,000,000 for the complete properties of the company.

Attorney James T. Shaw for the telephone company, and his assistants, deposited on the commissioners' table forty-four thick volumes said to contain the appraisement of everything the company possesses.

The case began with the application of San Francisco for reduction in telephone rates. The company responded by asking to have the investigation made State-wide.

After the presentation of exhibits the commission granted an indefinite adjournment, probably of two months, to give the parties time to study two years' accumulated evidence.

Paul Morris, who up to August, 1914, owned the Tuolumne telephone exchange, serving Tuolumne, Tuolumne county and a number of ranches near by with telephone service, has asked the railroad commission for authority to sell this system to George H. Jones and W. T. Gurney. In August, 1914, Morris sold the telephone system to J. A. Livingston, not knowing that it was necessary to have the commission's consent. Livingston later sold the system to George H. Jones and G. B. Neagle, and Neagle last September sold his interest to W. T. Gurney. All these transactions were made without the consent of the commission, and Morris does not know the address of Livingston. He is therefore willing, he says, to sell the property directly to Jones and Gurney under an order of the commission.

The merger of the two companies operating in Southern California has been authorized by the state railroad commission, and as soon as the preliminaries of consolidation are arranged the Pacific Telephone & Telegraph Company will handle all the business, the Home company being absorbed by it. Probably a month will be required to conclude the deal.

District of Columbia

The public utilities commission yesterday authorized the American Security and Trust Company, trustee, to invest part of the sinking fund, held in trust under a mortgage of the Chesapeake and Potomac Telephone Company, of New York, in the first mortgage 35-year 5 per cent bonds of the Chesapeake and Potomac Telephone Company, of Virginia.

The Virginia corporation represents telephone property of the Chesapeake and Potomac Telephone Company, and the New York corporation is a holding company organized to finance operations of the Virginia and Washington companies.

Idaho

Just as soon as suitable equipment can be installed at Cascade a physical connection will be made of the Mountain States and the Hall rural telephone system making it possible to secure direct telephone connections between Boise and Lakeport via Cascade and Roseberry. The public utilities commission through Commissioners Freehafer and Erb who made an investigation of the telephone systems last week, will supervise the connection of the lines.

Illinois

The State Public Utilities commission on April 18 denied the application of the city of Peoria for a reduction of telephone rates in that city. Likewise the commission denied the application of the Central Union Telephone company for an increase in rates.

The commission fixed 55 cents as a fair rental for the Central Union Telephone company to pay the American Telegraph and Telephone company for the use of telephones. The Illinois company has been paying four per cent of its income.

The decision relative to the rental of telephones will affect telephone rates in practically every community in the state.

Action of the State Public Utilities commission in fixing 55 cents as a fair rental for the Central Union Telephone company at Peoria to pay the American Telegraph and Telephone company for use of each of its telephones, instead of 4 per cent of the gross receipts, does not necessarily mean rates will be reduced.

It means that the commission in future rate fixing cases will take 55 cents as the fair rental for a telephone instead of 4 per cent formerly asked by the company. Inasmuch as depreciation, upkeep, cost, investment and rate of income are also figured in when fixing rates, the reduction from 4 per cent when spread out over an entire system probably would amount to only a fraction of one per cent.

Decisions delivered by the Supreme court of Illinois affect not only the authority but the finances of the state public utilities commission.

One ruling, it is said, will cost the commission thousands of dollars. It is that transcripts of evidence covering orders of the commission, filed in court contest cases, must be paid for by the commission. The decision was delivered on an appeal from the Sangamon County court in a rate controversy involving the petition of the De Kalb County Telephone Company to increase rates.

Another decision, reversing the verdict of the Circuit court of Sangamon county, held that the commission is not a judicial but a supervisory body and, for this reason, had no authority to issue an order directing the Postal Telegraph Company to cease conducting a public telephone business in Illinois.

The commission makes the significant statement in the course of a recent order:

There is submitted in the record no valuation of the property of the East St. Louis Light and Power Company. The usual procedure in a case of this nature might involve a valuation of the property of the company and an analysis of operating expense. The record in this case contains little such information except that relating to increased expenses of operation which have been sustained by the company.

In passing upon a problem of this nature there are two principal issues for determination. The first of these is the issue as to whether, under normal conditions, the existing rates of the utility are excessive or discriminatory. The second phase of the problem relates to the extent to which present conditions are other than normal and the adequacy of the proposed changes to meet the abnormal situation. It must be realized that, due to high prices of fuel, labor, and the material necessary for carrying on utility operation, public utilities must have experienced increases in operating expense. This fact in itself, however, does not offer justification for an increase of rates, since it is possible that the rates heretofore charged under the more normal conditions which have previously existed were exorbitant or excessive. If, however, it can be reasonably shown that the rates heretofore in effect under more normal conditions have not been unreasonably high, then the problem is narrowed down to a determination of whether the rates proposed will give increased revenues of an amount which will adequately, but not unreasonably, reimburse the utility for the increases of operating expense which obtain, and whether the proposed rates are of a non-discriminatory and equitable character. The first portion of the problem as to whether the rates heretofore in effect under normal conditions have been unreasonably high might be answered by a detailed analysis of the expense of the company, a valuation of its property, and lengthy proceedings involving a large amount of time and expense.

The commission raised the rates without having a valuation. While it found a valuation unnecessary in view of the convincing showing which the company's records made, the commission also evidently saw that what the company needed was *prompt* relief and that if a valuation were gone into it could not get prompt relief.

In testimony before the commission, A. S. B. Cushing, statistician of the Public Service Company of Northern Illinois, presented figures to show how the cost of constructing service extensions has increased since the beginning of the great war. In regard to the study of the investment in a two-pole line extension Mr. Cushing said:

First, we have a certain amount of copper wire and two 35-ft. (10.6-m.) poles, the expense of shaving and painting the poles, labor for delivering and setting the poles, the usual cross-arms, insulators, braces and other hardware, and then the labor of putting up the braces, putting up the cross-arms and stringing the wire, the present total cost of such items being $77.40. To this amount we must add 10 per cent of the material cost for storeroom charges on the items which pass through our storeroom stock. This adds another $5.49. Then 5 per cent of the $77.40 must be added for drafting expense and general records. Another 5 per cent must be added for engineering and incidentals, which brings a total of $90.63.

Now, in a great portion of the company's territory the various telephone companies join in the investment for poles, and I have used in my calculations 35-ft. poles, because 35-ft. poles are required when the telephone company joins in the investment. Therefore I have subtracted from the aforesaid $90.63 a half interest in the poles, and that half interest is figured at $9 per pole. I have thus subtracted $18, leaving the net cost for a two-pole extension $72.63. This is the cost of such an extension with present prices.

To this amount must be added, continued the speaker, the customer's share of transformer capacity. That for a residential customer in the Public Service Company of Northern Illinois would average at the present time approximately $5.25. There would also have to be provided a service drop that averages 189 ft. (57.6 m.) of No. 8 double-braided weatherproof copper wire at a present cost of $12.68. Also, the weighted average cost of an electric meter for a residential customer at present costs would amount to $8.51. All of such items would have to be added to the $72.63, making a total of $99.07. These items are all charged to the capital account.

Authority to sell out to the Central Union Telephone company was asked in a petition filed with the state public utilities commission by the Eastern Illinois Independent Telephone company of Kankakee.

The Pitcher Telephone Company was authorized to increase its rates at Galena, East Dubuque, Stockton, Apple River, Scales Mound, Elizabeth, and Hanover. A one party business telephone hereafter will cost $24 a year and a one party residence telephone $15. Slight reductions are made for rural telephones.

Increased rates of the Dixon Telephone Company were approved, to be effective May 1. They are: Private residence line, $2 a month; two party residence line, $1.75; private business line, $3; two-party business line, $2.50; four-party residence line, $1.50.

An increase in telephone rates from five to ten cents for service between Pecatonica and Freeport was asked in a petition filed with the public utilities commission by the People's Mutual Telephone Company of Davis, Ill. An exchange is maintained also at Durand. A call, the petition states, would be three minutes in length with a charge of five cents for every minute in excess.

The Coles County Telephone Company and the Ashmore Mutual Telephone Company of Ashmore, Coles county, filed a joint petition with the state public utilities commission asking for authority for the Coles County Telephone company to purchase of the Ashmore Mutual Telephone company the plant at Ashmore.

The commission is asked in a petition to decide whether a telephone company has the right to prohibit the use of the German language over the wires.

The Watson-Gilmore Telephone Company, operating in Welton, Altamont, Edgewood and other towns in Effingham county, recently prohibited the use of German over its lines.

Gus R. Voelker of Edgewood and other subscribers

complain that this deprives them of service as they can speak only German.

The Macoupin County Telephone Company was authorized to issue $13,500 in second mortgage gold bonds.

The Chestnut Mutual Telephone Company filed a petition with the commission recently asking for the right to connect with the lines of the Mt. Pulaski Telephone Company, and also that the Commission fix rate for service. The Mt. Pulaski company, it is asserted, has refused to agree to plans for connecting the lines.

The Seaton Telephone Exchange filed a petition with the state public utilities commission asking for authority to increase its rates in Seaton, Mercer county.

The commission has issued an order authorizing the Mendon Telephone Company to increase its rate from $9 to $12 per year for telephones owned by the company, and from $6 to $12 per year for telephones owned and maintained by subscribers.

The Lomax Telephone Company has filed schedules for residence and business telephones and connecting fees on farm lines in Lomax. The change of rate involves an increase in residence telephones from $6.00 per year to $12 per year; business telephones from $12 per year to $24 per year, and on farm line connection from $2.00 per year to $4.00 per year.

Indiana

An agreement to pay commissions to telephone companies originating reverse-the-charges calls delivered on Bell lines was obtained from the Central Union Telephone Company at a meeting of its representatives with a committee of Independent telephone company operators and the Public Service Commission.

This puts an end to an old bone of contention between the two services and quiets a stream of complaints to the commission from small-town commercial and domestic elements.

The commission is asked in the committee report to approve the agreement without issuing a mandatory order. Some time will be required to put the plan into operation.

Thad E. Hanway of Monticello, secretary and treasurer of the Monticello Telephone Company, was chairman of the committee. Other members were William Donaldson of Chicago, auditor of receipts for the Central Union Telephone Company; Stephen M. Isom of Mitchell, president of the Mitchell Telephone Company and the Southern Indiana Independent Telephone Owners' Association; Max Hosea, secretary and treasurer of the Indiana Independent Telephone Association and traffic manager of the Indianapolis Telephone Company; F. V. Newman, assistant to Mr. Hosea in his company connection; D. H. Whitman, commercial agent for the Central Union Telephone Company; David F. Hall of Chicago, attorney for the American Telegraph and Telephone Company; C. M. Martz, owner of the Arcadia Telephone Company and a director in the Tipton Telephone Company, and O. L. Herdrick of the commission's auditing staff.

The Mooreland Rural Telephone company has filed a petition with the Public Service Commission asking for an increase in rates. The case has been set for hearing on April 23 at 10 o'clock in the morning and at this time objectors will be given a chance to be heard. The increases asked amount to approximately a net increase of 75 cents a quarter and the bills would be paid quarterly instead of by the month, reductions being made if the bills are paid within the first fifteen days of the quarter.

The company asks permission to charge a rate of $4 per quarter with 25 cents reduction, making a net of $3.75 per quarter for party line resident phones in Mooreland. The present rate is $1 a month. Independent line resident phones in Mooreland would cost the subscriber $5 a quarter with 50 cents rebate if paid within the fifteen day period. The present rate for this service is $1.25 a month. Independent business line phones in Mooreland would cost $6.75 per quarter, with 75 cents rebate, making a net of $6 per quarter, if the petition is granted. Business phones now rent at $1.50 a month.

ASKS TOLL CHARGES

The petition asks for a rate of $4 per quarter with 25-cent rebate if paid in the first fifteen days of the quarter for rural party lines, making the net rate for this service of $3.75 a quarter. The proposed rate for extension phones is $1.50 a quarter. The Mooreland Telephone Company would also discontinue free service to all other exchanges and asks for the establishment of a toll rate except with the exchanges at Blountsville, Losantville, Millville and Mt. Summit.

Under the present rates, lodges, schools, churches and similar public places the rate of $1 a month is charged and ministers are given a rate of one-half that charged other people. The petition asking for a rate increase ignores this class and the usual rate would apply if the petition is granted.

In denying a petition to the Home Telephone Company, of Noblesville, for an increase in rates, the Indiana commission set forth certain wartime theories which are of concern to most of the telephone companies and telephone company stockholders in Indiana as well as to the general public. The commission claims that high prices of material in wartime do not affect telephone companies as much as they do gas and electric light and power companies. It also finds that the petition company has been making a profit under present conditions. The statement says:

> Here is a company that has experienced a most unusual prosperity. Its past years have all been fat years. At this time of national need when men and institutions are called upon to sacrifice as they have never sacrificed before—when the full loaf is no longer asked or given, would it not be proper to ask, if necessary, which it is not, that the company now resort to the surplus of previous years, and make up any partial loss of profits if necessary from the excess profits of the past. And even if it were shown here that petitioner faced a period of meager returns instead of full profits as the records disclose, the commission would in the light of the uninterrupted and unusual profits of the past, hesitate to grant relief.

The commission's engineers found the cost of reproduction of the Noblesville plant $82,620 and the present value $69,900. These figures are a little higher than the costs found by the engineer of the company.

The commission does not say that it will refuse to consider increases in costs of operating telephone properties, but says "it must appear that those increases in cost do materially increase operating expenses."

The company spoke of increased cost of labor, but did not "show that certain specific increases were to be made" and the commission refused to speculate on what increases might be. It is found that the stockholders have paid in since the company began a total of $15,640, which investment is now represented by a property the commission valued at $70,900. The increase in value has been made out of the earnings of the company, "and this

not to the exclusion of dividends to stockholders and interest payment on bonds."

The only change in rates authorized by the order is an increase from $1 to $1.50 a month for independent residence telephones. The commission finds there is discrimination in charging no more for an independent residence telephone than for a party line.

A petition signed by influential business interests of South Bend request that the public utilities commission of Indiana give attention to the telephone situation in South Bend. The petition points out that the Home Telephone Company was recently absorbed by the Central Union Telephone Company, that the service of both organizations is now under the direction of the latter company and that since the merger telephone service in South Bend is not what it ought to be, while many business houses and persons are put to the expense of double telephone service.

The petition expresses the belief that some action ought to be taken which will result in giving the people of South Bend better telephone service without unnecessary delay.

The Bippus Telephone company has filed with the commission a petition requesting permission to raise the rates. The increase asked is that business telephones be raised to $1.75 per month; telephones in Bippus, $1.50 per month, and the rural telephone service, $1.25 per month. The petition states that after paying all the necessary expenses there is not sufficient left to pay a reasonable interest on the investment. The officers named are Adam Schenkel, president; Daniel Schenkel, vice-president; Melvin A. Zent, secretary; Jacob A. Lahr, treasurer, and John Strobel, manager.

Kendallville will have but one telephone service in the course of a month or so, was the decision of the commission, in acting upon a petition asking for the merger of the Central Union Company and the Home property. The two exchanges will be consolidated just as soon as all necessary arrangements can be made. The commission will shortly fix the date when the hearing on the petition of the Bell company will be heard to adjust rates.

The Southern Telephone Company of Indiana has petitioned the Public Service Commission of Indiana for authority to establish higher rates for telephone service, the plea being based on higher cost of material, labor, etc. The company has headquarters at Evansville, and operates the Southern Indiana part of the Bell system, having a few years ago taken over the properties in this section of the Cumberland Telephone and Telegraph Company. Official notice of the petition has not been received, but the new rates to be established, if authority is forthcoming, are understood to be as follows: Residential telephones, direct line, increase from $1.50 to $2; the same, two-party lines, increase from $1.25 to $1.50 a month; business telephones, direct line, $3.50, no change; the same, two-party line, increase from $2.75 to $3.

Receivers for the Central Union Telephone Company of Indiana have filed petitions with the commission asking for increases in rates at Anderson and Shelbyville. For Anderson they ask an increase in one-party line business rates from $3.50 to $4.00; in two-party line business rates from $3 to $3.50; in one-party residence telephones, from $1.75 to $2.25; in two-party residence telephones, from $1.50 to $1.75, and in rural telephones, from 1.25 to $1.50 a month.

For Shelbyville they ask an increase on one-party business telephones from $2.50 to $3.50 a month; in two-party business telephones, from $2 to $3; in one-party residence, from $1.50 to $2; in two-party residence, from $1.25 to $1.50 and in rural telephones, from $1.25 to $1.50.

Chairman E. I. Lewis, C. A. Edwards and Edwin Corr of the Indiana Public Service Commission held a session at Lafayette to hear evidence in the fight to require the telephone companies to connect their lines so that Lafayette telephone subscribers may use their own telephones for long distance calls over the Central Union lines. Great inconvenience is alleged to have been caused by the fact that Bell long distance calls can not be received over any other than the Central Union wires. The commission will submit the question to the entire commission at Indianapolis before arriving at a decision.

The United Telephone Company, which operates the exchange at Huntington, at Bluffton and at Marion, has asked permission to give promissory notes for $350,000, due in two years for money to pay bills and to retire bonds.

The public service commission has granted a raise in the rates of the Monroeville Home Telephone Company, beginning the first of June. However, the telephone company is required to make certain improvements, among them being changing the country lines so that not more than ten will be on each line. The rates for business places will be $1.60 per month, residences in Monroeville $1.50 per month, country lines, $1.35 per month, with 10 cents off each month for cash payment.

The commission denied the College Corner Telephone Company's petition to increase its present rates.

Kansas

Application was filed by the Southwestern Bell Telephone Company with the public utilities commission for an increase in toll rates throughout the entire state of Kansas. Attorneys who filed the application said that the high cost of all materials entering into the upkeep, the operation and service demanded by the public made it necessary to ask for an increase in toll rates.

The Southwestern Bell Company also filed an application for a rehearing in the Wellington case decided by the utilities commission several weeks ago. The attorneys think these rates should be increased also.

Michigan

The Citizens Telephone Company of Grand Rapids has presented data as a basis for an appeal for permission to increase some of the city rates. The present rates are $24 for residence telephones, $36 for business telephones in the downtown districts and $42 for business telephones outside of the one-mile limit. The new rates asked for will be $28 for all residence telephones and $42 for the business telephones in the downtown district, leaving the business telephones outside the inner zone as they are. No change in present rates will be asked for party lines or extension telephones. The proposed increase will affect about 50 per cent of the subscribers. The increase will be asked for because of the greatly increased cost of maintenance and operation because of war conditions.

The Michigan State Telephone Company is asking the state railroad commission for authority to increase rates in about 40 of its smaller exchanges in the state and the Citizens is doing the same in about 25.

Minnesota

Field work on the state telephone valuation has begun in Nobles county, when crews headed by Charles E. Hoy of Minneapolis and George A. Bernier of St. Paul, as chiefs, started to make detailed inventories in this county, of all the properties of the Tri-State Telephone and Telegraph and the Northwestern Telephone Exchange Companies, devoted to long distance or toll service. The task of appraising the value of the toll lines in Minnesota was imposed upon the State Railroad and Warehouse Commission by the last legislature and the commission entrusted the actual work to D. F. Jurgensen, its chief engineer.

He has about 10,000 miles of toll pole lines extending to every corner of the state to enter upon his reports and as these must include a record of the condition of every unit entering into telephone construction and that, to the minutest detail, the task is an exacting one. If a sufficient number of capable men are available this season, it is expected that the outside work will be finished this year.

The notes now being taken not only give the commission a complete record of the telephone property in the state, but the data will also form a basis determining the reasonableness of the long distance or toll rates prevailing in Minnesota, which have been subject to some criticism.

It is ordered that the Albany Telephone Company be authorized to place into effect as of May 1, 1918, the following schedule of rates for local exchange service at Albany, Minnesota:

Individual line business	$2.00 per month
Two-party line business	1.50 per month
Individual line residence	1.25 per month
Two-party line residence	1.00 per month
Multi-party rural (company owned)	1.25 per month
Rural switching	.25 per month

It is further ordered that the company install an adequate system of records in accordance with the uniform system of accounts prescribed by the commission.

In the matter of the application of the Ivanhoe Telephone Company for authority to increase its local exchange rates at Ivanhoe, Minnesota, the commission finds that under the present rates the revenues of the company are sufficient to provide for the operating expenses, maintenance, depreciation and a fair return on the claimed value of the plant.

It is therefore ordered that the application be denied and the case dismissed; also that the Ivanhoe Telephone Company install a system of records and accounts in accordance with the Uniform System of Accounts for telephone companies prescribed by the commission.

The Wastedo Telephone Company is authorized to place into effect, as of May 1, 1918, the rate of $1.00 per month for each of its subscribers served by the system.

The Hendrum Telephone Company is permitted to place into effect, as of May 1, 1918, the following schedule of rates for local exchange service at Hendrum, Minnesota:

Individual line business	$1.75 per month
Individual line residence	1.25 per month
Rural multi-party	1.25 per month

Service within the village to be paid for monthly in advance, and all rural service to be paid quarterly in advance.

It is further ordered, that the Hendrum Telephone Company furnish all facilities and equipment necessary in rendering telephone service to its subscribers.

The Hutchinson Telephone Company is permitted to place into effect as of May 1, 1918, the following schedule of rates for local and rural telephone service at Hutchinson, Minnesota:

Individual line business	$2.75 per month gross
Two-party line business	2.25 per month gross
Business extensions	.50 per month net
Individual line residence	1.75 per month gross
Two-party line residence	1.50 per month gross
Four-party line residence	1.25 per month gross
Residence extension	.25 per month net
Multi-party rural	1.50 per month gross

Desk telephones in residences, 25 cents per month in addition to the regular rate.

A discount of 25 cents per month to be allowed if the bill is paid on or before the 10th of the month following that in which the service is rendered, except for rural multi-party service, a discount of 25 cents per month will be allowed if the bill is paid on or before the 10th of the month following the quarter in which the service is rendered. All service to be billed at the gross rate except where quoted net.

It is ordered that the Blue Earth Valley Telephone Company discontinue its two-party business service and its two-party residence service, or file with the commission a revised schedule of rates, establishing a rate for two-party business service and a rate for two-party residence service, which is substantially less than the present rate, charged for one-party business and one-party residence service, respectively.

The application of the Blue Earth Telephone Company for an increase in its telephone rates is denied and the application dismissed.

Applications of the Polk County Telephone Company, the Farmers' Two Rivers Rural Telephone Company, and the People's Telephone Company for increased rates at Beltrami, Bronson and Bigfork, Minn., will be heard on May 6, 7 and 9, respectively.

In the matter of the application of the Northwestern Telephone Exchange Company to purchase certain properties of the Thi-State Telephone & Telegraph Company; and the application of the Tri-State Telephone & Telegraph Company for authority to purchase certain exchanges and toll lines in Minnesota of the Standard Telephone Company, and the application of the Tri-State Telephone & Telegraph Company for permission to purchase certain telephone exchanges and toll lines of the Northwestern Telephone Exchange Company in the State of Minnesota;

Whereas, the Northwestern Telephone Exchange Company, the Tri-State Telephone & Telegraph Company have filed application with this Commission for the purchase by the Northwestern Telephone Exchange Company of all the properties of the Tri-State Telephone & Telegraph Company situated north of a line described as follows:

Commencing at the northeast corner of the county of Washington, westward along the northern boundary of the county of Washington; thence southerly along the western boundary of the county of Washington; thence westerly along the northern boundary of the county of Ramsey to the northwest corner of said county; thence southerly along the westerly boundary of Ramsey county to Dakota county; thence westerly along the northern boundary line of Dakota, Scott, Carver, McLeod, Renville and Yellow Medicine counties to the westerly boundary of the State,

And the Tri-State Telephone & Telegraph Company to purchase certain of the properties of the Northwestern Telephone Exchange Company and the Standard Telephone Company, south of said described line, in the State of Minnesota, a more detailed

statement of said properties being on file with this Commission, and,

Whereas, the petition of said companies requests that said matters be consolidated and heard at the same time, and,

Whereas, these applications are filed pursuant to and in furtherance of an agreement between said companies to eliminate duplicate telephone service and to consolidate the operating practices throughout the State of Minnesota;

It is therefore ordered, that the said application of the Northwestern Telephone Exchange Company to purchase certain properties of the Tri-State Telephone & Telegraph Company, and the application of the Tri-State Telephone & Telegraph Company to purchase certain properties of the Northwestern Telephone Exchange Company and the Standard Telephone Company be, and are hereby, consolidated, and,

It is further ordered, that all parties interested in said transfer be heard by the Commission on the 29th day of April A. D. 1918, at 10:00 a. m., at the office of the Commission, State Capitol Building, St. Paul, Minnesota.

Nebraska

Not only is the increase of rates asked for by the Farmers' & Merchants' Telephone Company of Alma denied by the state railway commission, but in the order written by Commissioner Wilson and concurred in by Chairman Hall the company is directed to pay no more dividends to its stockholders until they have contributed $12,715 to reimburse its treasury for an unwise investment in real estate not needed to operate the telephone exchange. Commissioner Taylor will write a dissenting opinion.

The commission further directs that repairs and betterments to the company's plant, including exchanges at Alma, Orleans, Stamford, Republican City and Woodruff, with farm lines and connecting trunk lines, shall be made as fast as its revenues under existing rates will permit. Details of new construction and replacements specified as necessary are:

New trunk lines from Alma to Republican City and Orleans, and changing all grounded circuits to metallic.

New switchboards for Alma and Republican City, their capacity to be sufficient to take care of reasonable future growth.

All open wire construction in Alma, Orleans and Republican City to be replaced with cables, where the lines suffer material interference from trees.

Main lead running west from Orleans to be rebuilt, and rural pole lines to be replaced with cedar poles and sufficient wire to give service without putting more than ten parties on one line.

Until these requirements are met, the company is forbidden to declare or pay any dividends or to issue any obligations for their future payment.

An additional part of the order provides that $9,000 now carried in a depreciation account shall be turned into the company's surplus, and that $12,000 be then set aside from the surplus for a "maintenance and depreciation" account, to which shall be added monthly, beginning with last January, the sum of $510 for current maintenance and depreciation.

The Alma Company asked for a raise in residence rates from $1 to $1.25 per month at all the towns where it operates, and also in the farm switching rate from 25 to 45 cents per month. It also requested authority to discontinue system service—under which patrons on one exchange talk with those on the others without paying toll charges—but this part of the application was afterward withdrawn.

It is declared in Commissioner Wilson's opinion that the company purchased four lots at Alma, when one would have been sufficient for its purpose, and proceeded to erect on three of these lots a large building and a garage. The greater part of the main structure is used for mercantile and lodge purposes, having nothing to do with the telephone business. Only a part of the garage is utilized by the telephone company.

STOCKHOLDERS ARE HELD

The investment of $12,715 in this manner is pronounced illegal and the stockholders are held by the majority finding to be liable for this unlawful expenditure of the corporation's funds, since they all consented to the transaction. It is therefore ordered that no dividends shall be paid them until the property has been sold for the amount stated or an equal sum has accumulated in the treasury through the non-payment of dividends, figured at 7 per cent.

Exclusive of the buildings and ground, the property is valued by the commission at $46,700. Maintenance and depreciation is provided for at 9 per cent, based on that sum.

A net surplus of $28,630 is shown by the company's books, says the Wilson opinion, which is more than sufficient to take care of all demands on the system and properly compensate the stockholders. The company is not suffering from lack of revenue, but from lack of capital, it declares. Its service is characterized as "poor and inadequate" because the equipment has been allowed to deteriorate.

In this case, Commissioner Wilson again propounds his theory that investors in a public utility are entitled only to a reasonable return, and that earnings realized in excess of that requirement must be held in trust for the patrons, and that any overplus from excessive rates which has been paid out as dividends or otherwise expended improperly can be recovered of the stockholders. The common law, on which this view is based, has support in statutory enactments, the opinion says.

Application has been made to the railway commission by the Farmers' Mutual Telephone Company of Ord, which is in reality a stock company, for permission to declare a stock dividend and increase its rates, which are alleged to be too low to return a profit. The company charges $1.50 per month on business telephones and $1 on residence instruments.

There is stock now outstanding to the amount of $9,350. The company says that it has never paid any dividends, and it now wants to issue additional stock to the shareholders as compensation for their going without returns during a number of years.

New Jersey

The application of the Delaware & Atlantic Telegraph and Telephone Company to buy certain telephone facilities and property owned by the Farmers' & Traders' Telephone Company, situated in Middlesex and Mercer Counties, was approved by the Board of Public Utility Commissioners.

New York

The New York Telephone Company has applied to the public service commission for permission to issue $25,000,000 additional stock. A hearing on the proposal will be held at Albany on May 3. The purpose of the issue, if allowed, is to reimburse the parent company, the American Telephone and Telegraph Company, for advances made in the past. The latter owns all of the $125,000,000 outstanding stock of the New York Company.

"The commission recognizes that the company has had unusual conditions to contend with and that it has so far expended its best efforts to meet the situation. The commission through its inspections will use its efforts to cure remediable defects in service as they may appear."

This statement was in a memorandum, accompanying an order of the Public Service Commission, Second District, closing upon the records of the commission a complaint by Henry Nordheim against the New York Telephone Company's service in Bronx County. Mr. Nordheim claimed the company's service is inadequate because of an insufficient plant and shortage of operators, that the service contract of the company is unjust in that no refund is allowed in case the minimum number of messages is not used and that certain coin machines deceive and cause a loss to the public. The memorandum says:

"Anticipating the difficulties of the complainant in bringing forward technical evidence the commission has in connection with this case caused a careful examination of the telephone service in the Bronx to be made by its own experts, with the view of ascertaining whether there is need of changing the proceeding and making an investigation upon its own motion. While inspections are being made by the employes of the commission constantly throughout the entire city, special attention has been given to the service in the Bronx. For some months past the telephone service has suffered and has, generally speaking, been below the previous standard. The causes for this have been carefully traced, the investigation reaching to the company's school for operators, the general conditions of employment, and the unusual difficulties in securing materials and equipment. The net result of this shows that the New York Telephone Company is alive to the situation and has so far been able to maintain a fairly good grade of service throughout the city. There is a tremendous volume of traffic handled successfully, and the observations of the commission's inspectors covering many thousands of calls do not disclose faults and operating errors in such numbers as to warrant severe criticism. Mistakes on the part of operators and failures of service for numerous reasons must be expected, but the relative number of such errors and faults is very small in comparison with the bulk of the traffic which is successfully and satisfactorily handled. That there is room for improvement even the telephone company itself does not deny."

The coin machines alleged to be deceptive, the memorandum says, were found to be confined to the one central office located on City Island in connection with a small magneto exchange where the type of coin box must necessarily be different from that in use elsewhere in the city. The company gave assurance that this central office was now in process of being changed to conform with apparatus in use in the rest of the city and anticipates the completion of this work within the next two months.

Ohio

The State Public Utilities Commission formally granted the Cleveland Telephone Company permission to raise its rates.

The permission is retroactive, and dates back to January 1. It also orders the company to improve its service immediately by installing measured service by which telephone users pay for each call made.

Members of the commission said the company could put the raises in effect immediately and not wait for the decision of the State Supreme Court which now has before it the question of whether council or the State Public Utilities Commission has control over rates and service in Cleveland.

The company contends the state commission has full jurisdiction over the rates and service, while the city says the home rule gives council this right.

In its order the commission says the rates the company seeks are "not unjust, not unreasonable, nor discriminatory, and not excessive," but that the present service is "inadequate and is not prompt or efficient, due to overloading of the lines and an insufficient number of operators."

"The company should at once begin measured service, starting first at the Main Exchange and then extend it to the Prospect, Rosedale, Garfield and Eddy exchanges," says the commission.

Preparations for measured service now are being made by the company and it is said that some exchanges can be ready for this sort of service by July 1.

Under the measured service plan the first 800 calls made from a single business line will cost 6 cents each every month.

The raises the company will be permitted to make under Friday's order if the Supreme Court upholds the jurisdiction of the state are:

$2 a month increase for single line business telephones.

$1 a month increase for single residence lines.

50 cents a month increase for two-party residence lines.

A limit of 50 outgoing calls a month for four-party lines with a charge of 4 cents for each additional call.

The Medina Telephone Company has prepared a schedule filed with the public utilities commission asking for a raise of twenty-five cents a month on all residence telephones and a raise of seventy-five cents on telephones used in stores in the outlying districts adjacent to Medina village, the raise to become effective July 1. Rates for office and business telephones in Medina are to remain the same under the new schedule.

An order from the State Public Utilities Commission to the Ohio State Telephone Company, restrains the latter from putting into effect the proposed increase in telephone rates in Toledo.

The opposition to immediate approval of the petition at the hearing in Columbus by Law Director Emery and Mayor Schreiber, caused the order to be issued by the commission. It is not expected that the final order in the case will be made before October 1.

The commission orders the company to make an inventory of its property used for serving the Toledo public by July 1. The receipt of the inventory is to be followed by a valuation of the property by the commission. Upon the valuation, the application of the company will be denied or granted.

The receivers, Central Union Telephone Company, announce that a new schedule of rates for Dayton exchange has been filed with the commission, effective May 1, in which the rate for two-party line business service has been changed from $42 per annum to $54. This change has been made necessary by the unusual increase in operating cost in the Dayton exchange and the heavy traffic generated by the two-party business subscribers. Representatives of the company are calling upon each subscriber to the two-party business service to advise them of the change and ascertain service desired at the new rates.

Increased rates asked for service at Canton by the Ohio State Telephone Company were allowed by the commission. The commission ordered that the company abandon all its sub-stations and serve all its patrons from its central plant, which will necessitate improvements. These improvements must be completed within six months, the commission ordered.

The Public Utilities Commission of Ohio has rendered a decision in the cases brought against the Star Telephone Company by various citizens of Lodi and other towns in favor of the telephone company. The decision reads as follows: "Upon consideration whereof, and being fully advised in the premises, the commission finds that defendant's rates herein challenged are neither unreasonable nor excessive, that the matters wherein defendant's service was alleged to have been inadequate and inefficient have been remedied, and that the discriminations complained of have been removed. It is, therefore ordered, that complaints be, and they hereby are dismissed."

The commission authorized the Cambridge Telephone Company to purchase the property of the Central Union Company in Cambridge for a consideration of $63,200.

Oklahoma

Campbell Russell, of the corporation commission, has laid down the broad principle that service is the first thing that the public demands of a public utility corporation, and that price fixing comes after that. This was brought forth in the matter of the protest from the Muskogee county democratic central committee against the order of the corporation commission to increase the toll rates of the Southwestern Bell Telephone Company in this state. Mr. Russell takes the position that the cost of help and all other operating expenses have advanced to such an extent that increased revenues cannot be denied. That the corporations must have increased revenues to give service and that the matter of determining just how much they shall be allowed to increase these revenues may come later but that the public demands service and must have it.

Oregon

Revised telephone toll rates, for "particular person" service, made on an air line basis, will be effective on and after April 21 as a result of an order of the public service commission, covering four Oregon routes of the Pacific Telephone & Telegraph Company, on which the two-number service is dropped. On two other routes between Portland and Oregon City and between Portland and Salem, the two-number service is retained.

The four routes for which the "particular person" rate is reduced 5 cents as the result of dropping the two-number service are: Between Albany and Cervalis; between Ashland and Grants Pass; between Ashland and Medford and between Grants Pass and Medford.

On the Portland-Salem and Portland-Oregon City routes the two-number rates are placed where they were before the filing of the recent new tariff. These are the only two-number routes remaining on the system in Oregon.

The rates to be effective April 21 are: Portland-Oregon City—Particular person rate, 15 cents first minute; 5 cents each additional minute. Two-number rate, 10 cents first three minutes; 5 cents each additional minute.

Portland-Salem—Particular person rate, 30 cents first minute; 15 cents each additional minute. Two-number rate, 25 cents first three minutes; 10 cents each additional minute.

The particular person rates for the routes on which the two-number service is dropped follow: Albany-Corvallis, 10 cents first minute; 5 cents each additional minute. Ashland-Grants Pass, 25 cents first minute; 10 cents each additional minute. Ashland-Medford, 15 cents first minute; 5 cents each additional minute. Grants Pass-Medford, 20 cents first minute; 10 cents each additional minute.

Pennsylvania

The Public Service Commission of Pennsylvania has dismissed the complaint of the Central Telephone Company against the Windber Telephone Company.

The Central Telephone Company alleged that the Windber Telephone Company was infringing upon its territory and that a telephone line was constructed without permission from the Public Service Commission.

The Public Service Commission, however, holds that the charter of the Central Telephone Company gives the company the right to construct the line in question. The Windber Telephone Company has a similar right and the commission may not restrain either from extending its lines or service.

The commission advises that the company officials meet in conference to obtain a satisfactory conclusion which the commission is powerless by order to impose upon them. The expense of operating two telephone lines in the same district may be avoided by such conference, it is suggested.

The territory in dispute is that about Cairnbrook, Paint Borough, Foustwell, Arrow, and Seanor.

P. M. Tebbs, Harrisburg, notified the Public Service Commission that the Bell Telephone Company has rectified the troubles he complained about recently. He filed a complaint recently to the effect that his bell was rung when there was nobody on the line or when he was not wanted.

"The publicity given to the matter has been such as to get the action desired," he wrote, "and I wish you would drop the complaint."

Utah

In an order in the Bear River Valley Telephone Company case, the public utilities commission of Utah countenances a rate of 8 per cent in dividends. As a result of the order, the rate for the business telephone in Tremonton will be raised from $3 to $3.25 a month; that for the individual residence telephone in Tremonton will remain at $2.50 a month, while service on the rural or party lines will be raised from $1.75 to $2 a month.

The findings of the commission, which are also made a part of the order, recommend the installation of additional wires as speedily as possible until not more than eight telephones are on any one party line.

The report is written by Commissioner H. H. Blood, and the members of the commission concur. In discussing the testimony, which was taken at a hearing at which the patrons, although granted an opportunity, were not represented, Commissioner Blood finds that the income for the past year was $13,294, and the disbursements, exclusive of the interest and dividend payments and depreciation were $11,319.53. However, he points to the fact that the system last year sustained unusual damage as a result of a violent wind-storm, and had been compelled to spend $2,000 to $2,500 additional that was unusual.

The commissioner therefore estimates that an average annual balance for interest, depreciation and divi-

dends would be $4,475.32. This he says is not sufficient to pay the following charges:

Interest on $19,000 bonds	$1,140.00
Depreciation at 6½ per cent	2,909.66
Dividend at 8 per cent	2,000.00
Total	$6,049.66

Commissioner Blood remarks that the valuation of the plant, as determined from testimony and from the company's books, is a trifle under $45,000. And it is on this item, of course, that the depreciation is based. He urges the annual allowance for depreciation. He said that the additional tariff will bring in a revenue of $1,569. The estimated revenue therefore is $6,044.32 above the operating expenses, and therefore within about $5 of the amount determined by the commissioner as proper, allowing for an 8 per cent dividend, and for depreciation, for which no allowance has been made in the past.

The company has 192 miles of pole line, 700 miles of wire, and 525 subscribers.

West Virginia

Asking for authority to double its rates, the Milton Telephone Company filed a petition with the Public Service Commission, according to a Charleston dispatch.

The telephone company wants to increase its rates for domestic telephones from 75 cents a month to $1.50, and business telephones from $1 to $2 a month, it is stated in the petition.

Wyoming

Application asking for an increase in telephone rates was filed with the public service commission by the Project Telephone Company of Powell, Wyo.

The public service commission set April 29 as the date for the hearing of the application of the Lusk & Manville Telephone system for an increase of rates in Lusk.

Springfield-Xenia Merger Denied

Rumors that the Central Union Telephone Company intended to merge with the Springfield-Xenia (Ohio) Telephone Company, was denied by A. C. Arend, manager of the Central Union Company.

"As far as I am aware, no move of this kind has been made," said Mr. Arend, "although I understand that rumors to that effect have been floating around. In regard to our recent purchase of property on Spring street, that is no indication that we have planned to combine the two companies. I know of a case where one of our companies purchased property, and held it for eight years before building."

Mr. Arend declared that extensive improvements are being made in the building which they are now using, which would not have been done if any intention of merging the telephone companies had been considered.

Automatic's Publicity Manager

Automatic Electric Company, Chicago, has a new manager of advertising and publicity in the person of Louis Falstreaux, former advertising manager of the Shaw-Walker Company at Muskegon, Mich. Mr. Falstreaux will take care of the rapidly broadening field of automatic advertising.

A. T. & T. Has Good Quarter

Much improvement was shown by the American Telephone and Telegraph Company in the first quarter of 1918 compared with the average of the first three months in 1916 and 1917. The company had $2,086,332 left after payment of all charges and deductions in the initial quarter, while the average in the preceding two years was only $1,969,414. This result was attained, despite greater dividends, larger interest charges and an increase in operating expenses.

The report for the quarter ended March 31, 1918, compared with the average for the same time in 1916 and 1917 follows:

Earnings.	First Quar. 1918.	Average First Quar. 1916-17.
Dividends	$ 7,504,534	$ 6,784,599
Interest and other revenue from associated companies	4,539,344	3,780,182
*Telephone traffic (net)	2,406,783	2,275,150
Other sources	287,347	543,318
Total	$14,738,008	$13,392,249
Expenses	1,597,190	1,494,647
Net earnings	$13,140,818	$11,897,602
Deduct interest	2,339,995	2,143,885
Balance	$10,800,823	$ 9,753,717
Dividends paid	8,714,491	7,784,303
Balance	$ 2,086,332	$ 1,969,414

*One month estimated.

The Bell Telephone system, which inc'udes the American Telephone and Telegraph Company and all its associated companies in the United States did not fare so well. The surplus for the quarter was only $2,935,000, compared with $5,447,671, the average for the first three months of the two preceding years. The Bell income account compares:

	*First Quar. 1918.	Average First Quar. 1916 and '17.
Operating revenues	$76,300,000	$66,641,252
Operating expenses	53,690,000	44,022,816
Net operating revenues	22,610,000	22,618,436
Total gross income	19,270,000	20,192,688
Total deductions	6,505,000	5,943,814
Balance net income	12,765,000	14,248,874
Dividends	9,830,000	8,801,203
Surplus earnings	2,935,000	5,447,671

*One month estimated.

The Bell system on March 31 owned 22,770,582 miles of wire, compared with 20,316,471 miles a year ago, and had 10,603,978 stations, compared with 10,113,703 in 1917.

Ohio District Meetings This Month

How to continue good service in the face of the increased cost of materials and labor, a larger number of subscribers and increased volume of business per patron, due to war conditions, and how to finance it all on a fixed scale of income, will be the burden of discussions at district meetings this month of the Ohio Independent Telephone Association.

President Frank L. Beam announced the meetings will be at Cleveland, Toledo, Lima, Dayton, Canton, Zanesville and Columbus, in the order named. The annual meeting planned for Chillicothe will not be held because of congestion due to the location there of Camp Sherman. A survey made by Mr. Beam shows there are 770,670 telephones of all kinds in use in Ohio.

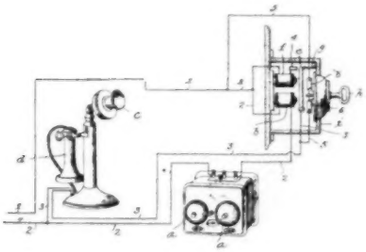
Telephone Patents Recently Issued

A Brief Digest of those Current Specifications Most Interesting to Telephone Men

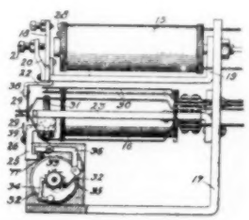
BY DAVID S. HULFISH

NO. 1,245,417. Signaling System. Issued to E. W. Adams, assignor to Western Electric Company, Inc., New York, N. Y. To telegraph a number, alternating currents of ten different frequencies are used, a short current of the proper frequency setting in vibration a tuned reed which by a local circuit continues vibrating and thus indicates "thousands," while the "hundreds" reeds then are switched into the circuit for the next signal, and so on until the full number has been sent.

1,245,472. Coin Collector. J. W. Lattig and C. L. Goodrum, assignors to Western Electric Company, Inc., New York, N. Y. An electrical toll-collecting device for nickels only has associated with it a mechanical device of such a nature that when a quarter is dropped into the mechanical device five nickels are delivered by it to the toll-collecting device, etc.



1,245,929.



1,246,201.

1,245,481. Finding Switch. Issued to M. K. McGrath, assignor to Western Electric Company, Inc., New York, N. Y. In a linefinder switch, the searching brush moves rapidly until it finds and passes the calling line, then moves backward slowly until it finds and stops upon the calling line.

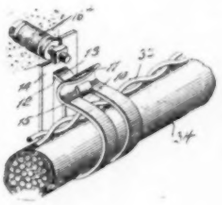
1,245,748. Automatic Switch System. Issued to A. E. Lundell, assignor to Western Electric Company, Inc., New York, N. Y. In an automatic exchange having searching linefinders, the same relay is used to control the searching of the linefinder and the subsequent searching of the first selector switch.

1,245,900. Order-Circuit System. Issued to C. L. Goodrum, assignor to Western Electric Company, Inc., New York, N. Y. The B-operator's telephone set is normally disconnected from the order circuits having access to it; any A-operator may connect with the B-operator's telephone set over an order circuit, and the B-operator then may operate devices to prevent any other A-operator from connecting until after the first order is served.

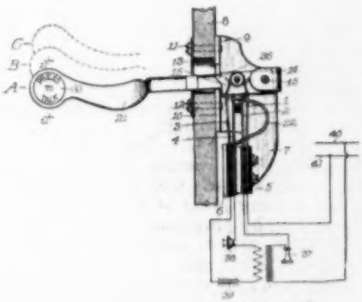
1,245,929. Restricted Telephone Set. Issued to Fred Lacroix, New York, N. Y. A switch box with a lock and key is provided. When the bell is rung for an incoming call, the call may be answered through electrical contacts set by the ringing current; when the bell has not been rung, the telephone may not be used to originate a call unless the key is turned in the lock. The use of the telephone thus is restricted for outgoing service to those persons having keys.

1,246,088. Searching Switch Release. Issued to C. L. Goodrum, assignor to Western Electric Company, Inc., New York, N. Y. When a searching switch reaches the last circuit over which the circuit for the searching brush could be completed, a release circuit is closed to restore the switch in case that last circuit also is ineligible.

1,246,125. Semi-Automatic System. Issued to A. E. Lundell, assignor to Western Electric Company, Inc., New York, N. Y. When an answering plug is placed in a line jack, automatic switches connect the operator's telephone set to the plug; the called line then is connected through the automatic switches, and the operator's telephone set then is automatically disconnected if certain lines are called, but is left on if certain other lines are called, the set being disconnected if a subscriber's telephone line has been called, but left on if a trunk has been called to another manual or semi-automatic exchange where the first A-operator must speak again to give the number to complete the connection.



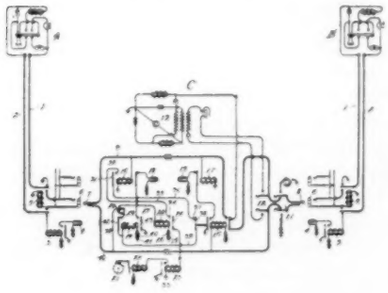
1,246,325.



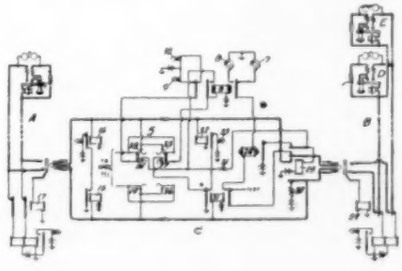
1,247,796.

1,246,126. Signaling System. Issued to A. E. Lundell, assignor to Western Electric Company, Inc., New York, N.Y. In a semi-automatic exchange, where a limited service line is connected from one operator to another, such a circuit is selected automatically for the transfer circuit that not only is the transferred call signaled, but also the character of service of the calling line is signaled to the second operator.

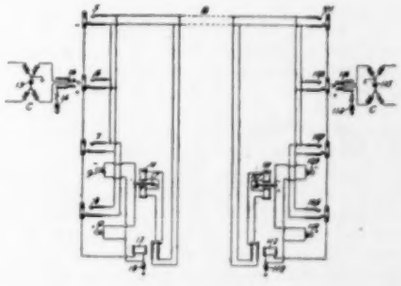
1,246,176. Linefinder System. Issued to A. B. Sperry, assignor to Western Electric Company, New York, N. Y. Lines are multipled into several linefinders, and when a first linefinder is operating to find a first calling line then a second calling line will start another linefinder, so that two calling lines will start two linefinders to seek the two calling lines without delay to the second line.



1,246,362.



1,246,546.



1,246,547.

1,246,201. Call Counter. Issued to S. B. Williams, Jr., assignor to Western Electric Company, Inc., New York, N. Y. The call counter is associated mechanically with the armatures of the line relay and cutoff relay in such manner that when the line relay is operated before the cutoff relay a call will be registered, but where the cutoff relay is operated before the line relay no record will be made, nor will record be made if the line relay is operated without the cutoff relay, as when the subscriber works his hook to call the operator.

1,246,325. Cable Clamp. Issued to G. E. Rohmer, Elmhurst, N. Y., assignor to Booraem & Roehmer Patent Company. The cable clamp is attached to a wall and has a spring cradle for the cable and a latch to hold the cradle closed after the cable has been placed in position.

1,246,362. Operator's Call Counter. Issued to R. I. Utter, assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. The meter is operated at each insertion of an answering plug. Each cord pair has a pair of relays for the meter, with but one meter for the operator's position, the one meter serving all cord pairs.

1,246,545. Linefinder System. Issued to H. P. Clausen, assignor to Western Electric Company, Inc., New York, N. Y. In a linefinder system of power switches, the lines are upon the brushes and the trunks upon the tag bank, and but one line may be connected to the power, so that each line must wait until the preceding lines are served, the selection of an idle trunk being associated with the power elements of the switches, not with the line brushes in the switch moved.

1,246,546. Ringing Selecting System. Issued to H. P. Clausen, assignor to Western Electric Company, Inc., New York, N. Y. The listening key has two positions of listening, the ringing key is independent of the listening key handle, and the ringing current selected for ringing upon a two-party line depends upon the position of the listening key handle when the ringing key is operated. The operator shifts the listening key to select the current, then rings.

1,246,547. Trunk. Issued to H. P. Clausen, assignor to Western Electric Company, Inc., New York, N. Y. The trunk has at each end two outgoing jacks without lamps and two incoming jacks with lamps. The operator selects an outgoing jack and by plugging into it lights a lamp at the corresponding incoming jack at the other end of the trunk.

1,246,548. Test of Switches. Issued to H. P. Clausen, assignor to Western Electric Company, Inc., New York, N. Y. An automatic arrangement for operating an automatic switch under test to select a predetermined bank tag, and a time limit device which does not operate if the predetermined tag is engaged within the time limit, but does operate to announce failure of the switch if the bank tag has not been engaged at the expiration of the time limit.

1,246,619. Trunk Selecting System. Issued to J. W. Lattig and C. L. Goodrum, assignors to Western Electric Company, Inc., New York, N. Y. When all the trunks from a private branch exchange are busy, a busy tone is given to a telephone calling for a trunk, and automatically if a trunk become idle the tone is removed and the line is connected to the new idle trunk.

1,246,625. Relay. Issued to A. E. Lundell, assignor to Western Electric Company, Inc., New York, N. Y. By an adjustment carried by the armature, the relay may be adjusted to make-before-break or break-before-make.

1,246,881 and 1,246,882. Selecting System. Issued to H. P. Clausen, assignor to Western Electric Company, Inc., New York, N. Y. The selections in the central office of an automatic exchange are fewer in number than the number of characters in the directory designation of the line to be called.

1,247,371. Switch Controlling System. Issued to W. W. Carpenter, assignor to Western Electric Company, Inc., New York, N. Y. An automatic switch is caused to take two selective steps for each single interruption of the call sender, except the last interruption, where it may take either two steps or one step as the number to be called is even or odd.

1,247,399. Automatic Switch. Issued to C. J. Hendrickson, assignor to Western Electric Company, Inc., New York, N. Y. The brushes are moved by the direct pull of a solenoid.

1,247,796. Transmitter Switch. Issued to W. W. Dean, assignor to Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. For farmer lines and party lines, to listen without transmitter. The hookswitch moves half way up and closes the receiver circuit when the receiver is lifted, then by a side push will move the remaining distance and close the transmitter circuit if it is desired to speak.

1,248,782. Party Line System. Issued to Clarence A. Anderson, Chicago, Ill. Each telephone of the line has a stepping switch and keys at the central office indicate different stations on the party line. When the key is set to indicate a station, an impulse device will send to the party line impulses sufficient in number to select the station indicated by the key, and then automatic means will stop the impulses.

1,248,868. Signal System. Issued to M. L. Johnson, assignor to Automatic Electric Company, Chicago, Ill. Plugging into a common battery line shows the operator a signal associated with the answering plug, which signal is not shown if a magneto line is plugged into. The difference is due to a difference in the resistance of the cutoff relays of the lines.

1,249,032. Meter. Issued to E. E. Clement, assignor to J. R. Garfield, trustee, Cleveland, Ohio. An integrating meter records when current flows to two connected lines, so that the total duration of the conversation may be indicated. (Application filed February 23, 1905.)

Cut Wires to Mexico

Telephone communication between Imperial county, Cal., and the Mexican State of Baja, California, was severed at midnight April 18 on orders from the War Department.

Manager J. F. Bezdecheck of the Imperial Telephone Company, a subsidiary of the Pacific system, gave orders to his linemen to cut the four trunk lines leading from Calexico to the switchboard at Mexicali, operated by the Company de Terrenos de Aguas de La Baja California S. A., the Mexican twin of the Imperial Irrigation district.

The irrigation district has also been ordered to disconnect its lines from Mexicali to its offices at the ten-foot drop, and the five gates heading, both on the American side. The only method of wire communication now left to Mexicali is wireless. Col. Cantu has a powerful station erected near the executive offices.

In Southwestern Bell territory also all telephone connection across the Mexican border has been severed.

It has been common property for months that German influence is strongly in evidence and at work across the Rio Grande and effective work has been done by the United States Government in maintaining a strict censorship at the various points along the border, especially where there was telephone communication with Mexican towns. Messages could be transmitted by spies to other spies across the river very easily by the telephone, the messages being so worded in conversation, apparently innocent gossip, that it would be next to impossible to detect the real purport.

For this reason the Southwestern Telegraph and Telephone Company cut its wires.

The telegraph wires are still in operation as the censorship is rigid and there is very small chance that any message of hidden meaning would ever start on its intended journey.

Illinois Commission Splits "4½%"

The Illinois State Public Utilities Commission has denied the application of the city of Peoria for a reduction of telephone rates in that city.

Likewise the commission denied application of the Central Union Telephone Company for an increase in telephone rates.

The commission fixed 55 cents rental for the Central Union Telephone Company to pay the American Telephone and Telegraph Company for the use of telephones. The Illinois company has been paying four and one-half per cent of its income.

The commission permitted the Peoria company to discontinue its four-party business telephone and establish an individual and two-party business telephone. It fixed a rate of $42 a year for the individual telephone and $26 for the two-party business telephone. It fixed 720 calls a year as the maximum number for the year over these telephones and allowed the company four cents additional for each call over that number. The decision relative to the rental of telephones will affect telephone rates in practically every community in the state.

Of Interest to the Trade

What the Telephone and Accessory Manufacturers are Doing to Advance the Art

What the New Kellogg Factory Represents

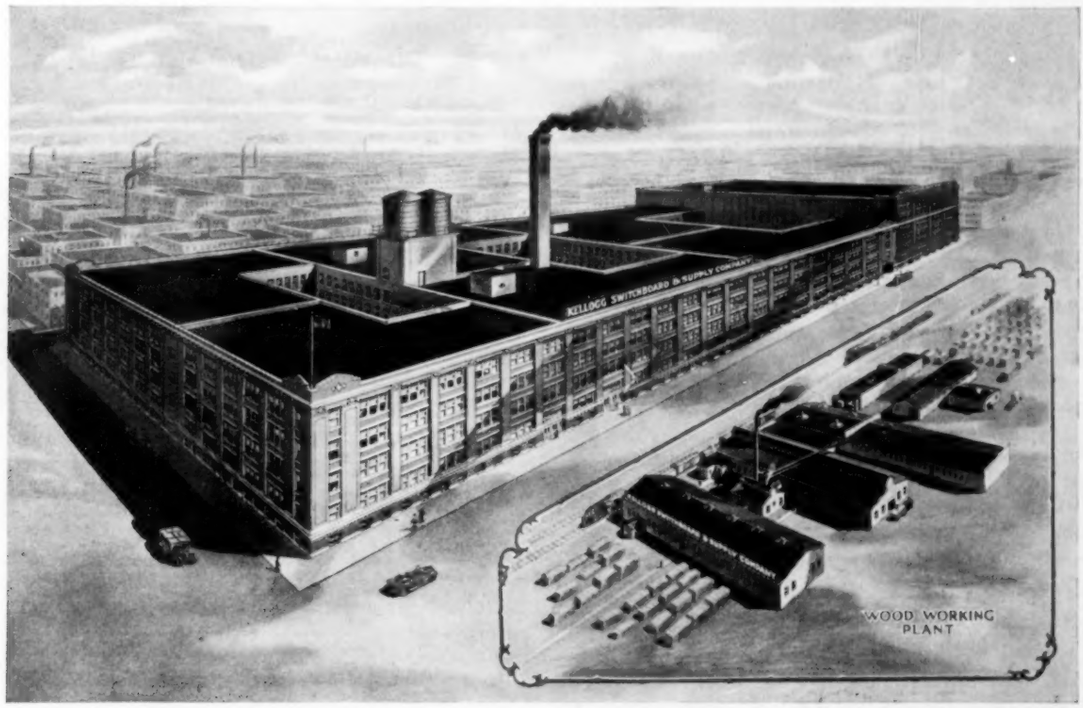
The growth of the Kellogg Switchboard & Supply Company, such as the increased building facilities it has been necessary to acquire, are well brought out in the following brief sketch of the company's factory history:

First, in Highland Park, Ill., a small suburb some miles out of Chicago where rent was cheap, it was able in the early days to start off in an abandoned school house. It looked like a suburbanite's summer home more than it did a factory for building telephone apparatus. In those early days, when everything had to be done to supply growing demands, and an organization made from whole cloth, the Kellogg company purchased most of its parts upon the market. It was, in fact, an assembling plant, except when engineering and inventing skill was required to improve such things as it was able to purchase from others. For from the very beginning—and in this lies the secret of the Kellogg company's substantial growth—it employed the very highest grade engineers and inventors in this specialty that could be obtained.

In an incredibly short time, the old house in Highland Park proved to be entirely inadequate. With this evidence from the field also came courage to those responsible for it in the company, and in July, 1899, they moved into the heart of the Chicago manufacturing district, at the southwest corner of Congress and Green streets.

After about three years at the new location, they were forced again to fold their tents and move to larger quarters. They were very fortunate in their extremity for more space, just at this time, in being able to secure the large building just across the street upon the northwest corner of Congress and Green streets, August 1, 1902. This, they thought, would give them a permanent home, it seemed so large and spacious compared with the vacated quarters.

January, 1904, they found again that this large, new building was inadequate to handle the growing demands of the business, and they were obliged to remove their entire switchboard department to an isolated building on Jefferson street, near Jackson boulevard, some blocks from the home factory.



The Big Kellogg Telephone Plant. The Insert Shows the Wood Working Plant at Cassopolis, Mich.

Later on, they found themselves again climbing over material and finished products without room for a small truck to navigate down the aisle, and on May 1, 1912, they were forced to lease about 150,000 square feet of additional floor space in a large manufacturing building on South Clinton street.

About this time they were obliged to organize and incorporate their entire cabinet works at Cassopolis, Michigan. This department consists of a completely equipped woodworking and finishing plant with dry kilns accommodating a carload of timber, and modern woodworking machinery; this plant consisting of 40,000 square feet of floor space.

At this juncture they found themselves again crowded and also scattered so that the best and most economical manufacturing could not be had. To make a long story short, they erected upon the corner of Adams

and Aberdeen streets, Chicago, the present modern and spacious four story manufacturing building.

This structure has a floor area of 404,000 square feet, over nine acres of floor space. It is 396 feet long and 238 feet deep. Having three large courts, every bit of space receives plenty of natural light and ventilation, making working conditions ideal. Every department is arranged so as to eliminate unnecessary steps, consequently all orders are filled without delay.

Last fall the Kellogg Company was again crowded for space and found it necessary to construct a six story addition 66 feet wide by 396 feet long, to its present building. The Kellogg factory now has a floor space of 584,000 square feet, over 13 acres.

The accompanying illustration shows the present Kellogg factory with the Cassopolis plant in the foreground.

Simplicity Demountable Wheels Successful

The Simplicity Wheel Company, of Grand Rapids, Michigan, announces that it is meeting with a large measure of success. The company started in a small way a little over a year ago. It now occupies a splendid, new, modern home with full daylight on all sides and over twelve thousand feet of floor space. This building is located near the center of the business district at the corner of Louis and Ottawa streets. The offices and salesrooms occupy several hundred feet on the ground floor where practical demonstrations of the Simplicity Demountable Wheels for Fords are to be had at any time.

The officers of the Simplicity Wheel Company are F. B. Raymond, president; F. W. French, vice-president; George Clapperton, secretary-treasurer; W. C. Everette, general manager.

The utility of the Simplicity Demountable Wheel outfits is evidenced by the fact that they are sold from coast to coast to thousands of commercial car owners for laundries, dry goods and department stores, taxicab, express and telephone companies and, in fact, in every line of business where prompt service is necessary. One Chicago firm with branches all over the world has already equipped 750 of its Ford cars with "Simplicity" Demountable Wheel outfits during the past few months. This is but one of many other nationally known concerns that have "Simplicity" standard equipment on all their Ford cars.

One of the largest rubber companies in the country is installing Simplicity Demountable Wheels throughout the United States at its service stations owing to the fact that it found its tires wore better where installed with Simplicity Demountable Wheels because the regular standard Ford equipment is used and there is no unslung weight as with demountable rims.

The wheels can not work loose and wobble nor wear the spindle, either of which causes a side play on the tread for which they were not built and thus causes them to wear out long before the guaranteed life of the tire.

The Simplicity Wheel Company is making many shipments to foreign countries, among which are Australia, New Zealand and Siam, besides various countries in South America and Europe—and in fact almost every country where Ford cars are in use.

Edmonton Automatic Exchange Closes Ten Years Successful Service

Superintendent J. E. Lowry of the Municipal Telephone System operated by the city of Edmonton, Canada, in his report for 1917 brought out the fact that on May 5, 1918, the exchange would complete a decade of service as its lines were cut over to Automatic in May, 1908.

The records of the system show a steady growth during the last ten years. In 1908 they had in operation 645 telephones while on January 1, 1918, 9,634 stations were in service. This represents an increase of almost 9,000 phones in ten years, or an average gain of three per business day.

The serious effect of the world war upon the use of the telephone caused the loss of some 1,500 subscribers during the years 1915 and 1916, but strenuous commercial endeavors coupled with an excellent advertising campaign retrieved the ground lost and the system is today very close to the 10,000 mark if that figure has not already been reached.

The financial condition of the system is excellent. After all operating expenses, interest and a 6½ per cent depreciation charge had been met, a net profit of over $20,000 was shown for the year 1917. This represents eight per cent of the total rental revenue, as Edmonton receives no toll revenue, and this record was achieved in the face of high wages, scarcity of help and very heavy traffic.

A Telephone Truck Equipped with Simplicity Demountable Wheels.

The telephone development in Edmonton is very high, being one station per five inhabitants, with comparatively low rates, $24 per year for straight line residence service and $45 for business phones. The calling rate is over 10 per station per day.

The total maintenance (central office and subscriber's stations), and operating labor and material cost was $3.50 per station in 1917, about 10 cents per phone less than in 1916. Trouble on the Edmonton system during 1917—the tenth year of operation—averaged less than one and one-half cases per station for the 12 months.

The company has in operation a policy of charging applicants for service, for the labor cost of the installation, charges being made against the capital account of substations and a credit back to a special operating account. Upon a station being disconnected these charges are reversed. This policy has been found very beneficial in stabilizing the capital account and prevents inflation by the cost of extra labor.

"Loyal endeavor by each and every member of the

system to give the best service possible is responsible for the present very excellent condition of the company" was the opinion of Mr. Lowry.

Death Ends Fifteen Years Service

C. F. H. Franke, for 15 years a member of the staff of the Automatic Electric Company, passed away at his home in Winnipeg early this month, following a prolonged illness.

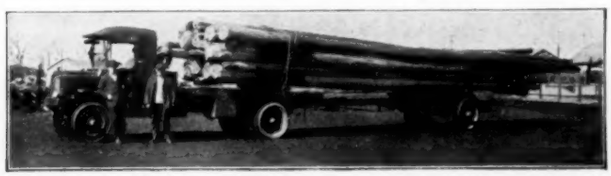
Mr. Franke became connected with the Automatic Company first in the capacity of foreman of the switchboard department. Later he was assigned to experimental work and when in 1914 the branch factory was opened in Winnipeg, Canada, Mr. Franke was made superintendent and given charge of the new factory.

In the fall of 1917 Mr. Franke's health began to fail and he retired from active work, but until his death he kept in constant touch with the details of the business.

Born February 16, 1862, Mr. Franke is survived by a widow and several children.

15-Ton Loads on Semi-Trailer

Telephone and electric light companies throughout the country are making use of semi-trailers in solving their haulage problems, according to H. C. Fruehauf,



3½ Ton Truck Hauling 15 Tons of Poles.

general manager of the Fruehauf Trailer Company of Detroit.

The cut shows how the Detroit-Edison Company of Detroit hauls long poles with a 3½-ton truck, and adjustable reach semi-trailer, the load weighing 30,000 pounds.

Mr. Fruehauf says that this type of trailer is in great demand in the western and southern oil fields as well as logging districts.

"Some of the oil and lumber operators have reduced their haulage costs 200 per cent by using semi-trailers with their motor trucks," said Mr. Fruehauf.

Save the Concrete

One of the chief causes of cracking in concrete surfaces is the presence of moisture in the surrounding atmosphere. In the warm months this moisture has no detrimental effect but in winter time it collects in the tiny pores of the concrete and freezes. The freezing action with its concurrent expansion exerts a pressure on the surrounding concrete and causes tiny cracks to appear. These cracks in turn fill with moisture and the chipping action continues until spring comes with its higher temperature. This chipping and cracking of the surface of the concrete detracts both from the appearance and the strength of the concrete.

A sure way to prevent this destructive action is to thoroughly coat the surface of the concrete with a floor dressing paint. This coating preserves the texture and individuality of the concrete and prevents all moisture from penetrating the surface. If new concrete floors are covered with two coats of this paint and recoated at intervals of about six months the concrete surface will remain unscarred and without cracks. The use of this "crack preventive" is becoming greater each year and many factories use it in large amounts.

Ohio Automatics Convene

Automatic telephone managers of Ohio held their quarterly meeting in Marion, April 22, thirty-five visitors being in attendance from all sections of the state. A session was held at the exchange building and after a luncheon at the Marion club house at noon, the managers again went into session.

The meetings are held for the purpose of improving the service and automatic system in every department. Each plant has a man on a general inspection committee to pick out any flaws that might be found inside or out of the exchange.

This work was done Sunday by the committee and the report of the inspection was made later.

Various topics along the lines of operation and systems followed were brought out by the different managers and the meeting was one of the best that has been held for some time.

General Insulate Company Becomes Co-operative

General Insulate Company, 1008-14 Atlantic avenue, Brooklyn, N. Y., well-known moulders of "Insulate" and "Hi-Heet" specialties, which company some years since inaugurated a bonus system among its employees and which bonus system has produced excellent results for all concerned under the energetic direction of V. C. Rockhill, general manager of the company, has now gone a step further and become a co-operative concern.

Henceforth all employees of the company, both those in the factory and the field, will participate in the net earnings of the General Insulate Company.

The company's management is to be congratulated in the foresight it has shown and the liberal manner in which it is endeavoring to compensate its co-workers.

"Keep Off the Line"

The women of the Utah state council of defense have been working on a "keep off the line" campaign, whereby the groceryman will have a chance to call up his customers and get orders for the day's purchases. The campaign was conducted throughout the city and state.

With only one delivery a day permitted under the new regulations, it is explained, some families have had to go without groceries because neighbors kept the line busy with private telephone conversations, so that their providers could not reach them in time to send out the needed goods.

It is the intention of the patriotic women of the defense council to prohibit this in future.

Western Electric Figures

Because of curtailment in demand for new construction on the part of the Bell Telephone system, Western Electric's gross sales, so far this fiscal year, have shown a moderate decline from the 1917 figures. In its year to December 31 last, Western Electric handled a gross business of $150,340,359, an increase of $43,353,682, or 40.5 per cent over the previous year. So far during 1918, gross has been running at the rate of $130,000,000 per annum a decline of $20,000,000 or 13.5 per cent.

Du Pont Photograph Contest

To increase the interest in Du Pont Products and to secure suitable photographs to illustrate the advertising and publicity of their various companies the Du Pont American Industries offer $500.00 in prizes for the fifty best photographs.

The prizes are as follows:

First prize	$100.00
Second prize	50.00
Two third prizes, each	25.00
Fourteen fourth prizes, each	10.00
Thirty-two fifth prizes, each	5.00

The photographs have to illustrate the following subjects, and be submitted before September 1, 1918.

Agricultural Uses of Explosives.
Fabrikoid (Artificial Leather).
Industrial Uses of Explosives.
Painting.
Trapshooting and Hunting.
Miscellaneous.

Any subjects illustrating the use of any Du Pont Products, will be given equal consideration.

Some of the conditions of the contest are:

No employes of the Du Pont American Industries are eligible in this contest.

Each photograph to be eligible for a prize, must be accompanied by the negative (film or plate).

On the back of each photograph submitted must be plainly written the name and address of the contestant, the subject illustrated, the place where the photograph was taken and any other helpful data.

The number of photographs that can be submitted by any one contestant is unlimited, nor is there any limit upon the number of prizes that can be won by any contestant.

All photographs submitted, whether or not awarded prizes, are to be come the property of the Du Pont American Industries.

All photographs submitted will be judged by a committee to be appointed by the Director of Advertising of the Du Pont American Industries. Prizes will be awarded not later than September 15, 1918.

The Du Pont Photograph Contest will close on September 1, 1918. No photographs postmarked at Wilmington, Del., later than September 1, 1918, will be accepted in this contest.

Each contestant must fill out and mail an entry blank to the Advertising Division, Du Pont Company, Wilmington Delaware, *with the first photographs submitted* or the photographs will not be accepted in the contest.

All photographs entered in this contest must be plainly marked "Photograph Contest" and mailed to the Advertising Division, Du Pont Company, Wilmington, Delaware, full postage prepaid.

SHOULD BE EASY TO WIN A PRIZE

Du Pont products are used or sold in almost every business house and home in this country. Probably in your own home, or in the neighborhood or at least where you work there is a good chance to get a prize winning photograph.

A word to the amateur, be sure your photograph has good contrast, is clear and sharp in focus. If possible, have it at least 3x5 inches, in size.

Experience prompts us to say when you have taken your photograph, make a black and white, glossy finish print.

Send the print, *with the negative, and your entry blank* to the Advertising Division, Du Pont Company, Wilmington, Delaware. Be sure and mark it "Photograph Contest."

Don't try too hard to get an "unusual effect." This is not an art contest. These photographs are to be used for advertising purposes and if they show clearly and effectively what they are supposed to represent and will reproduce well they will have a good chance of winning a prize.

Any one desiring to enter should notify the Du Pont Company and an entry blank will be furnished. Address Advertising Division, E. I. du Pont de Nemours & Co., Wilmington, Delaware.

Ohio Automatic Men Meet at Marion

A regular meeting of the Ohio Automatic Telephone Association, with representatives present from eleven cities in Ohio operating automatic equipment, was held at Marion, on April 21 and 22.

No official meetings were held Sunday, but an extensive inspection was made of the Marion exchange and installation. The beautiful new building is a marvel of completeness and the equipment, both central office and subscribers' station, is of the very latest type.

The convention was called to order Monday morning by President A. J. Curren, of Elyria, and the delegates were welcomed by Mr. Guthrey, president of the Marion County Telephone Company. Following the regular order of business, A. J. Berry, general manager of the Marion Company, gave a short talk on the conditions which led his company to adopt the automatic systems.

As guests of the Marion Company, the delegates enjoyed luncheon at the Marion Club, and following the afternoon session made an auto tour of the city and points of interest in the surrounding territory.

Those present at the meeting were: Jasper McBride, Cambridge, Ohio; J. D. Park, Kenton; A. J. Berry, Marion; N. P. Bartley, A. E. Co., Chicago; L. Falstreaux, A. E. Co., Chicago; Seymour Hirsch, A. E. Co., Toledo; Fred L. Sears, Cambridge; P. C. Trinter, Lorain; Chas. E. Hollander, Newark, Ohio; F. B. Moody, Elyria; G. H. Schlegel, Newark; R. K. Judy, St. Marys; H. P. Mahoney, A. E. Co., Columbus; A. E. Gray, Elyria; H. O. Dutter, Bucyrus; Harry Loveen, Bucyrus; D. C. Bryan, Bucyrus; W. L. Frolick, Bucyrus; C. J. Kelley, Bucyrus; I. Geitgey, Lorain; O. Frailey, Youngstown; Roy Owens, A. E. Co., Columbus; Geo. G. Cooper, Marion; A. J. Curren, Elyria; Frank Luedeke, St. Marys; A. J. Stoltz, Bucyrus, Ohio; M. B. Evans, Columbus.

Skinderviken Telephone Equipment Co.

The Skinderviken Telephone Equipment Company has been organized by J. Skinderviken, who is already well known to telephone men, and who is president and general manager of the new company. O. E. Ray is secretary-treasurer. The company's office and factory is located at 2136 North Clark street, Chicago, where work upon a number of telephone specialties is going rapidly forward.

The most interesting product of the company is the Skinderviken Transmitter Button, whose peculiar merits were described in TELEPHONE ENGINEER last November. Further tests of this ingenious transmitter improvement have borne out all of its early promises.

The company is also marketing the Skinderviken Automatic Battery Saver and the Skinderviken Private Service System. Catalogs are now ready for distribution.

Local Battery Telephone Bulletin

Bulletin No. 1024 of the Stromberg-Carlson Telephone Manufacturing Company consists of 24 pages and cover devoted to the subject of "Local Battery Telephones." It is profusely illustrated from photographs and scale drawings and explains in detail the many interesting and valuable points of improvement recently made in the Stromberg-Carlson line of magneto instruments.

The company will be glad to send a copy of Bulletin 1024 to anyone who is interested in telephone work, upon request to the office at Rochester, N. Y.

Western Electric 1917 Business Breaks Records

The biggest year in the Western Electric Company's history was 1917, according to the figures contained in the annual report of the directors to the stockholders, which has just been issued. The gross income for the year was more than $150,000,000. The report, which is signed by Mr. Thayer on behalf of the directors, reads as follows:

"The business of the company has been larger than in any previous year. This is true of both the sale of its own manufactures and in the sale of merchandise not made by it. In our own manufactures the demands from regular customers (the Bell Telephone Companies) were very heavy at the beginning of the year, but as the demands for equipment to meet emergency requirements directly or indirectly caused by the war have increased, the ordinary requirements have decreased so that to a large extent a more expensive and less profitable business kept us busy during the latter part of the year. Therefore, while the profits in this class of business have been larger than in 1916, they have not, as compared with earlier years, been in proportion to the increased investment in the business.

"On sales of merchandise not made by us the profits have been very satisfactory.

"There is no return from foreign investment included in the profits of the Company for 1917. As to some, information is entirely lacking, and as to others, it is incomplete. It is our belief, however, that, as a whole, a conservative valuation of them would require no addition to reserves, the earnings of some of them being apparently sufficient to offset the possible losses of others.

"On the entry of this nation into the war we practically placed our Engineering Department at the service of the nation and believe that it has rendered important service. This has involved large expense and indirect loss through the interruption of our regular engineering program, but because we believed that we were able to render great service, we believed also that the responsibility upon us to render it was great and that our stockholders would approve of our action. On such orders as we undertake for the military departments we have agreed to a basis of cost plus a very moderate profit.

"The difference between present cost and cost on the basis of prices before the war on buildings and equipment added to the plant during the year has been credited to Reserve for Depreciation on Plant.

"It has seemed wise on account of the large merchandise investment and the prevailing high costs to set aside to the Reserve for Contingencies $2,000,000 and on account of the large increase in the number of employees since the establishment of the Employees' Benefit Fund there has been added to that Fund the sum of $500,000.

"Our shop force increased during the year from 18,928 to 21,549 employees. The total number of employees at December 31, 1917, was 30,737.

"The sales for 1917 were $150,340,000. For 1916 they were $106,987,000, and for 1915 they were $63,852,000.

"The orders on hand at December 31, 1917, were $1,950,000 in value less than on December 31, 1916. The average value of an order filled during 1917 was $107 as compared with $75 for 1916.

"The total disbursements from the Employees' Benefit Fund for 1917 amounted to $173,915. These payments covered all classes of benefits and were made to 2,894 beneficiaries.

"Statements of Earnings and of Assets and Liabilities of this Company and its constituent companies in the United States are appended."

Girls Join Signal Corps

A new unit of Signal Corps telephone operators is composed of twenty-eight young women in charge of Miss Nellie F. Snow, chief operator, formerly a chief operator for the New England Telephone & Telegraph Company in Lowell, Mass. Two supervisors are attached to the unit, Miss Marie L. Beraud of West Hoboken, N. J., and Miss Elizabeth E. Roby of Chicago.

Seven members of the unit are from California, six from Massachusetts, five from Illinois, four from New York State, three from New Jersey and one each from Washington, Minnesota and Ohio.

The operators are the Misses Marie B. Belanger of Rochester, N. Y.; Suzanne M. Beraud, West Hoboken, N. J.; Michele F. Blane, Boston, Mass.; Marie L. Bousquet, San Francisco, Cal.; Suzanne Coheleauh, Astoria, L. I.; Lucille de Jersey, Covina, Cal.; Miriam de Jersey, Covina, Cal.; Frances des Jardins, New York, N. Y.; Maria Flood, Chicago, Ill.; Yvonne M. Cauthier, Lowell, Mass.; Louisette N. Gavard, Newark, N. J.; Blanche Grand-Maitre, Minneapolis, Minn.; Adele L. Hoppock, Seattle, Wash.; Bertha M. Hunt, Berkeley, Cal.; Margaret Hutchins, New York, N. Y.; Janet R. Jones, Newark, Ohio; Hope Kervin, San Francisco, Cal.; A. Maude McMullen, Fitchburg, Mass.; Margaret H. Milner, Berkeley, Cal.; Eugenie Racicot, Lowell, Mass.; Dorothy L. Sage, Evanston, Ill.; Martha Steinbrunere, San Francisco, Cal.; Bertha J. Verkler, Chicago, Ill.; Lillian R. Verkler, Chicago, Ill., and Bertha Wuilloumier, Boston, Mass.

Telephone Building for Red Cross

The Northwestern Telephone Company has donated the use of its big building at the corner of First avenue and Fifth street north, Fargo, N. D., for the salvage department of the Fargo branch of the American Red Cross.

The building, of two stories and full basement, was formerly occupied by the company's offices and exchange.

There are no restrictions in the company's donation.

Big P. B. X. Traffic

It is estimated that more than 10,000 telephone calls are handled daily by the switchboard operators employed at Willys-Overland, Inc. More than 600 telephones are distributed through the factory and offices. About 500 telegraph and cable messages are received at the Toledo office of the company each day.

"Telephone Call Wire Circuits"

EDITOR TELEPHONE ENGINEERS—Referring to Mr. R. E. Crane's criticism and evident misunderstanding of the statement in my article, "Telephone Call Wire Circuits," in February issue regarding y, I wish to call attention to the fact that (1-y) is equal to $1 \frac{1}{1200}$ x total calls per hour $= 1 \frac{n}{1200}$; and does not equal $\frac{1199}{1200}$ as Mr. Crane assumes, except for the case of one call per hour. This case, as stated in the second paragraph of my article, is not considered.—L. C. EDDY, JR.

Brevities of the Business

The Activities of the Whole Telephone Field Told in Short Paragraphs

PERSONAL NOTES.

The Chesapeake and Potomac Telephone Company has announced that Leo D. Mahon, commercial supervisor at the Baltimore, Md., business office, has been appointed district manager at Washington.

E. Burnett, Gurdon, Ark., manager for the Southwestern Bell Telephone Company, has been transferred to the Dermott exchange.

Charles W. Wason, a director of the United States Telephone Company and the Cuyahoga and Federal Systems, died recently.

Ellis B. Baker died recently in St. Petersburg, Fla. He was a pioneer in the telephone industry and formerly lived in New Haven, Connecticut, where for twenty-three years he was general manager for the Southern New England Telephone Company. Prior to that time he had opened a commercial exchange in Meriden, the second of its kind in the country.

C. O. Strong is the new manager of the Bell Telephone Company at Carlisle, Pa., succeeding C. W. Heilhecker, who has been transferred to Bellefonte.

The Southwestern Telegraph and Telephone Company announces the appointment of R. A. Van Cleave as district manager of the Corpus Christi, Texas, district, succeeding E. G. Ferrell, who has been transferred elsewhere. Mr. Van Cleave, who heretofore has been district traffic manager, will have charge of all of the affairs of the company in Corpus Christi and in other parts of that district.

F. G. Smith, who has been manager of the Elwood Company in Sac City, Iowa, has resigned to enter the employ of the Sioux City Telephone Company.

Richard Pagel, manager of the Onaway-Alpena company at Rogers City, Ohio, has resigned and accepted a similar post at Warren, Ohio.

O. H. Bynum, who for the past six years has been manager for the Cumberland Telephone and Telegraph Company at Alexandria, La., with supervision over Central Louisiana, has been transferred to Monroe, where he will be manager for the same company. He is succeeded by A. P. Baird, who has been manager at Monroe.

W. S. Mallalieu has been transferred from the position of local manager of the Bellefonte, Pa., telephone exchange to that of local manager of the Williamsport exchange. W. Neilhecker, manager at Lock Haven, will take his place. Charles O. Strohm, commercial representative at Carlisle, has been made local manager at Lock Haven.

Joe P. Badour, former manager of the Jackson exchange of the Citizen Telephone Company and who for the last two and a half years has held the position of manager of the Coldwater, Quincy, and Girard exchanges of the Southern Michigan Telephone Company, has tendered his resignation.

I. C. Toepleman, general manager of the Home Telephone and Telegraph Company at Henderson, N. C., came in contact with a heavily charged wire while making a survey, and was instantly killed.

Frank Elgan, district commercial manager of the Iowa Telephone Company at Council Bluffs, Iowa, died after being ill for a week with indigestion.

Col. J. W. Ozment, president of the Palestine Telephone Company, of Palestine, Texas, and well-known pioneer business man of that city, died recently after a short illness.

E. W. Ferris is the new manager of the telephone company at Robinson, Ill., having succeeded F. E. Drysdale.

Charles Fleetford Sise, president of the Bell Telephone Company of Canada, who served as an officer on the Confederate privateer Alabama during the civil war in the United States, died in Montreal.

C. H. Abbott, for several years associated with the Southwestern Telegraph and Telephone Company at Dallas, Texas, as publicity agent, has resigned his position to enter other work.

P. J. Gilder has been made manager of the Southern Bell Telephone Company at Florence, succeeding G. L. McCullough, who has been made district manager.

John Collins has resigned his position as manager of the Logan Home Telephone Company at Logan, Ohio. Mr. Fetterjohn will take the place of Mr. Collins.

H. O. Seymour, general manager of the Wisconsin Telephone Company, has been elected a director of the Chain Belt Company.

W. E. Betiaux is the new manager of the Cedar Falls, Iowa, district of the Iowa Telephone Company.

J. B. Taft, division publicity manager for the Bell Telephone Company, with headquarters in Harrisburg, has been appointed copy manager for the Bell Telephone Company of Pennsylvania and associated companies, including the Central Diamond State Telephone Company and the Delaware and Atlantic Telephone Company, with headquarters at Philadelphia, effective May 1. Mr. Taft will be succeeded as district publicity manager by H. E. Prevost of Harrisburg.

NEWS FROM THE FIELD.

ARKANSAS.

A new 105-drop switchboard has been ordered for the Greenbrier telephone exchange.

CALIFORNIA.

According to reports from Forest Supervisor Cunningham, forest rangers are replacing fifteen miles of telephone line between the Mehrten ranch on the South Fork of Kaweah river and the Braddock ranch on the North Fork.

The Pacific Telephone and Telegraph Company has issued notice that it will sell $600,000 worth of bonds in June, and with the money construct a telephone line between Los Angeles and San Francisco.

ILLINOIS.

At a recent meeting of the directors of the Cuba Central Telephone Company the proposed private telephone line between Cuba and Fiatt became a reality. It was unanimously decided to begin the work of building the private line as soon as workmen could be secured.

At a meeting of the telephone shareholders of the Augusta Mutual Telephone Company the directors elected were: R. B. Booker, C. H. Mead, E. L. Thomas, and C. O. Pitney.

At the annual meeting of the Boone County Rural Telephone Company three directors were elected. Mrs. Henry Biester, in place of the late Frank W. Plane, and F. A. Reed and Harlow Huntington. The latter two were re-elections. F. A. Reed was re-elected president; Harlow Huntington, in place of Mr. Plane, elected vice-president; Thomas Reed, treasurer, and Arthur Orr, secretary and general manager. The last two were also re-elections.

INDIANA.

A ruling by the Indiana public service commission will permit the merging of telephone systems in three northern Indiana cities. The Home Telephone Company will purchase the Bell system at Fort Wayne, and the Bell Company will take over the Home system in Kendallville and Auburn.

Converse Consolidated Telephone Company changed its principal business from Converse to Indianapolis.

The Broad Ripple telephone exchange burned recently from an unknown cause. Communication, as a result, has been temporarily suspended, but repairs will be rushed as much as possible.

IOWA.

The telephone line connecting the Creston Mutual line east to a point near Afton direct with Mt. Ayr, which was discontinued some time ago by the Bell Telephone people, has been restored to service.

Articles of incorporation were filed by the Alburnett Telephone Company of Alburnett. The company is capitalized for $10,000, and E. R. Balderson is named as president and Edwin Haehlen as secretary.

VIRGINIA.

The Stewartsville Telephone Company of Stewartsville has been incorporated with a capital of $5,000 by R. B. St. Clair, and W. Huddleson.

The Whitacker Telephone Company of Whitacker has been incorporated with a capital of $5,000 by W. C. Whitacker, president, and R. C. L. Whitacker, secretary.

WASHINGTON.

Mrs. Kate Whitmore, who has held a position on the switchboard of the telephone office at Dayton for several years, has just been promoted to the position of manager, to succeed A. F. Wyman, who has resigned to return to the Atlantic coast.

WISCONSIN.

A deal has been consummated whereby the holders of the stock of the Mt. Horeb Independent Telephone Company have transferred their interests to J. A. Pratt of Menomonie Falls and J. F. O'Connell of Madison.

The quarterly meeting of the directors of the Wisconsin Telephone Company was held on Thursday in the general offices at 418 Broadway, Milwaukee. The following officers were elected for the year: President, B. E. Sunny; vice president and treasurer, Alonzo Burt; vice president, H. F. Hill; general manager, H. O. Seymour; general auditor, B. S. Garvey; general counsel, Eugene S. Wilson; secretary, W. I. Mizner.